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**The Institute of British Foundrymen**
**The Institute of Vitreous Enamellers**
**The Welsh Engineers' and Founders' Association**
**and**
**The Foundry Trades' Equipment and Supplies Association**

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## *The Engineer and the Foundry*

Lord Austin's speech to the Birmingham Branch of the Institute of British Foundrymen awoke many memories and controversies of the past. Once again the foundry trade was referred to as the Cinderella of the engineering industry. We have attempted to analyse the reason for this neglect—now happily passing—of the foundry industry in the past by engineers, and we feel that in the metamorphosis of foundry work from a craft to an industry, many difficulties were encountered because of the previous artistic background of the craft and the artistic temperament of the craftsman. The original craftsmen were artists, they, like Benvenuto Cellini, created their works of art and cast them in their own workshops for the permanent admiration of posterity. The difficulty of major importance, however, was the artistic temperament—a factor which still worries the producer of opera—of the skilled moulder. The engineer throughout the industrial era found the moulder to be of charming personality, but conservative in his attitude towards his craft. Those moulders possessing perhaps less of the artistic temperature and more of the urge to make money tended to migrate to the United States of America. Here they encountered conditions capable of developing the essentially utilitarian side of their craft. Thus it has come about that the mechanisation of the industry is probably of American origin.

Whilst great attention was being paid to the mechanical aspect of foundry practice in the United States, Europe was grafting on to it, the principles of scientific metallurgy. During the last decade, Europe has also mechanised its foundries, whilst America has raised the standard of its foundry research work to the same level of that prosecuted in Europe. Thus to-day there are three integrating factors—the foundry specialist, the metallurgist and the engineer; these must co-operate for the intelligent operation of the foundry, and where an establishment is insufficiently large to warrant the employment of three individuals, then the foundryman must acquire sufficient knowledge of engineering—mechanical and electrical—and metallurgy to ensure his foundry is rightly taking its place in the current development of the industry. The "Cinderella" appellation is to-day as much a myth as the fairy story from which it derived its name, and in truth reference to it as such is doing the industry a distinct disservice.

## *Export Trade*

In our Annual Review Number, Mr. F. W. Firth drew attention to the three aspects of the present trade situation, rearmament, plant extensions to make good the neglect of the depression period, and export trade. Again and again we have been warned by Ministers and business leaders of the importance of export trade, which in 1936 was only 60 per cent. of that of 1929. It is inevitable that some drop should take place following our change in tariff policy, but we cannot take the view that such a policy means the extinction of export trade secured in open competition with other exporting nations as distinct from that negotiated through trade agreements with other countries. In this case high tariff nations like the U.S.A. would never have had an export trade at all, whereas in reality they are great exporters of finished products. The position is that if a country produces the goods that are needed at the right price, other countries will buy them regardless of tariffs. Highly specialised products embodying all that science and skill can put into them are most likely to meet the case. The only condition remaining is that buyers should be in a position to purchase, and here the signs for a world trade recovery are very encouraging. Taking pig-iron and steel as basic commodities, the world production of steel in 1936 was over 120 million tons, an increase of a fourth over 1935, and the largest since 1929. For pig-iron the increase was nearly as large, production reaching nearly ninety million tons. Great Britain's contributions were 11,700,000 tons of steel and 7,700,000 tons of pig-iron. Germany and Russia lead this country in production of both these materials in Europe, the United States having a larger output than any European country. All these signs mean that all producing countries are sharing in the trade expansion and that their purchasing power is increasing. They will, therefore, be in a position to buy, if we are able and willing to supply. How essential this is we see from the fact that we imported in 1936 a value approaching double our exports. Our exports were only 60 per cent. of the 1929 imports, whereas in 1929 they accounted for 68 per cent. Tariffs, in this respect, therefore, have not made for a more favourable balance of trade.

# The Institute Elects New Members

At a Council meeting of the Institute of British Foundrymen, held at Bradford on January 16, the following were elected to the various grades of membership:—

### As Subscribing Firm Members

Bradley & Foster, Limited, Darlaston, Staffs; Constructional Engineering Company, Limited, Titan Works, Birmingham, 12 (representative, D. H. Wood); Corn Products Company, Limited, Bush House, Aldwych, W.C.2 (representative, A. M. Wilson; Goss Foster, Limited, Soho Works, Greenbank Street, Preston (representative, H. J. Howe); F. H. Lloyd & Company, Limited, James Bridge Steel Works, Wednesbury (representative, F. J. Hemming); Sternol, Limited, Royal London House, Finsbury Square, E.C.2 (representative, J. G. A. Skerl, D.Sc.).

### As Members

A. V. Biggs, commercial foundry manager, G. Adlam & Sons, Bristol; R. Blayock, works manager, Darlington Railway Plant & Foundry Company; E. T. Brooks, representative, T. Hill Jones, Limited, London; B. Brown, general manager, Suffolk Iron Foundry, Limited, Stowmarket; G. M. Callaghan, foundry manager, H. Pontifex & Sons, Birmingham; J. J. Casey, foundry engineer, Ford Motor Company, Limited, Dagenham; F. Cousans, steel foundry metallurgist, T. Firth & J. Brown, Limited, Sheffield; W. Dayson, departmental manager, T. Firth & J. Brown, Limited, Sheffield; T. A. Dunnicliffe, manager, R. Pendlebury & Company, Gorton; E. K. Gould, iron and brass founder, Tredegar Foundry, Newport; Y. R. W. Granström, foundry superintendent, Norrahammars Bruk, Norrahammars, Sweden; H. Hewins, proprietor, Port Foundry, Brimscombe; S. C. Jones, sales engineer, Northern Aluminium Company, Limited, Banbury; J. L. Kinnell, mechanical engineer, C. P. Kinnell & Company, London; C. Parfit, Lans Foundry, London, E.; R. O. Pritchard, foundry superintendent, Widnes Foundry & Engineering Company, Widnes; W. D. Pugh, works superintendent, Darlington Forge, Limited; C. W. J. Purnell, foundry and works manager, Blackburn Aeroplane Company; A. G. Robiette, B.Sc., metallurgist, Birmingham Electric Furnaces, Limited; H. J. Roe, manager, Maples Foundry Company, West Bromwich; H. M. Sands, works manager, A. Green, Limited, Chesterfield; W. A. Smart, managing director, T. R. Creighton, Limited, London, E.1; C. W. Stewart, foundry manager, Shotts Iron Company, Limited, Edinburgh; A. Swain, assistant foundry manager, Ruston & Hornsby, Limited, Lincoln; W. C. Tuke, foundry cost accountant, Ley's Malleable Castings Company, Limited, Derby; A. Wildman, general manager, Whittaker Bros., Accrington; F. Whitehouse, foundry manager, Newton, Chambers & Company, Limited, near Sheffield.

### As Associate Members

H. Balme, foreman moulder, Kaye & Company, Huddersfield; A. Brady, casting shop foreman, Stanton Ironworks Company, Limited, near Nottingham; H. Brittain, foreman patternmaker, Newton, Chambers & Company, Limited; E. Bryant, iron moulder, Austin Motor Company, Limited, Longbridge; R. Buchanan, engineering draughtsman, Babcock & Wilcox, Limited, Renfrew; J. Carter, assistant foundry manager, Blackstone & Company, Limited, Stamford; E. Chappelow, foreman moulder, T. Chappelow & Son, Batley; K. W. Chivers, ironfounder, Evans & Company, Writhlington; R. P. Clark, assistant foundry manager, Camelon Iron Company, Falkirk; H. G. Cochrane, B.Sc., foundry pupil, Ley's Malleable Castings Company, Derby; W. Collinge, assistant foreman, T. Jones & Son, Little Lever; P. R. Dell, pattern moulder, Camelon Iron Company, Falkirk; H. R. Gordon, foundry foreman, Westinghouse Brake & Signal Company, Chippenham; S. Gorton, patternmaker, Walmsleys, Limited, Bury; D. Gould, patternmaker, Head, Wrightson & Company, Limited, Thornaby-on-Tees; A. G. Grivell, foreman moulder, Aero Engines, Limited, Bristol; C. A. Harrison, foundry foreman, Ley's malleable Casting Company, Derby; G. W. Hitchings, non-ferrous foreman, Aero Engines, Limited, Bristol; J. Hobkirk, foreman blacksmith, Camelon Iron Company, Falkirk; A. Howell, foundry foreman, Vaughan Crane Company, Openshaw; W. C. Keen, patternmaker, Lennox Foundry, Limited, London; J. S. King, iron moulder, J. & T. Boyd, Glasgow; E. C. Lane, foundry representative, Brecknell, Munro & Rogers (1928), Limited, Bristol; D. Lawrence, assistant foreman, S. Russell & Sons, Leicester; H. Letherland, inspecting engineer, T. Firth & John Brown, Limited, Sheffield; F. E. Lewis, moulder, Rudge Littley. Limited, West Bromwich; W. C. Marshall, works inspector, Ley's Malleable Castings Company, Derby; S. Moody, iron moulder, Broad & Company, London, W.7; A. D. Morgan, moulder, Bath Foundry Company; H. Macmillan, foreman patternmaker, Camelon Iron Company, Falkirk; W. McAllister, foreman moulder, Gray & Caldwell, Limited, Paisley; J. McMullen, chemist and metallurgist, United Steel Companies; W. A. Oakey, moulder, J. Williams (Cardiff), Limited; W. Paterson, foreman moulder, Camelon Iron Company, Falkirk; G. M. Phillips, patternmaker, Austin Motor Company, Limited, Longbridge; T. Rigby, assistant foreman iron moulder, J. Varley, Limited, St. Helens; F. A. Ross, foreman patternmaker, Austin Motor Company, Limited, Longbridge; L. Saunders, moulder, Ley's Malleable Castings Company, Limited, Derby; K. A. Spencer, B.Sc., metallurgist, Winget, Limited; T. Taylor, patternmaker instructor, S.E. London Technical Institute; D. Tierney, foreman moulder, S. Russell & Sons, Leicester; P. Tromans, assistant works manager, Holman Bros., Limited, Camborne; J. Vickery, assistant foundry manager, Brecknell, Munro & Rogers, Limited, Bristol; W. Wearing; C. M. Wight, foundry estimator, Sir W. G. Armstrong, Whitworth & Company, Limited; A. D. Wilson, foreman engineer, Camelon Iron Company, Falkirk; W. Wilson, cupola hand, E. Allen & Company, Limited, Sheffield; K. H. Wright, chief works chemist, C. Akrill & Company, Limited, Gold's Green Foundry, West Bromwich.

### As Associates

A. Chappelow, apprentice, T. Chappelow & Son, Batley; W. Linnins, enameller, R. & A. Main, Limited, Camelon; K. Lloyd, draughtsman, Sir W. G. Armstrong, Whitworth & Company, Limited; R. Masterton, engineer's patternmaker, H. Wallwork & Company; W. E. Potter, foundry chemist, Ashmore, Benson, Pease Company, Limited, Stockton-on-Tees; J. G. Turnbull, foundry apprentice, A. Herbert, Limited, Coventry.

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SPEAKING AT THE annual dinner of the Midland area of the National Union of Manufacturers, held at Birmingham, last week, the Earl of Dudley replied to criticisms of the iron and steel industry, and declared it could put forward an example of perfect co-operation with the Government, of keeping faith with its customers and the consumers, while trying to do its bit to spread over the boom period. They did not want boom periods, but normal periods of trade. They believed that it was only by giving their customers that confidence which could be attained by level prices that they could do it. He hoped that would be the policy of every industry.

# Random Shots

"Marksman" is always being told that travel is a wonderful brain-sharpener, and whilst in Sheffield last week-end he certainly learnt a few things—"picked up" was the phrase which first came to mind—but out of fairness to the Royal Vic. and its peculiar surroundings, 'twere better to find a happier word.

* * *

First of all, "Marksman" was startled to discover that "1066"—that grand old date—does not refer to the invasion of King Conqueror, but to the Annual Review Number of THE FOUNDRY TRADE JOURNAL. Secondly, that a refractory ball is not a device used to plug up tapholes, but the annual binge of the blokes who sell sand to foundries.

Like Mr. Sydney Walton, "Marksman" is a layman in things appertaining to foundry practice, but he did see a few members of that noble profession doing a bit of jolting and squeezing. . . . Thirdly, he was surprised to learn that "Vat 69" is the telephone number of the Holy See, and that it would lead to less confusion if he asked for Johnny Walker.

To be serious, the Refractories Ball was, as usual, a very excellent event. In fact, it is always so full of the unexpected that "Marksman" almost takes the unexpected for granted now! The programme and menu, in the form of a driving licence, was an engaging and original idea, and one almost burst forward with a desire to enjoy oneself—with much the same sense of relief and release—as one does when the traffic light turns from red to green. Lovely ladies Russelled by in gorgeous dresses, and it was an extraordinarily Silacene when the Turkish Ambassador had to rub shoulders with his hated poor relation, the carpet seller. . . .

* * *

By the way, why don't the railways provide better food? Travel may broaden the mind, but it certainly contracts the stomach. This menu *may* be retained by the customer—if he is lucky. But perhaps "Marksman" was just feeling the worse for his revellings the night before. . . .

* * *

After dining well a few days ago at a provincial dinner of an I.B.F. Branch, "Marksman" joined a number of the gay congregation who descended by road in the early hours of the morning to a member of the party's chateau at an inland resort. Fearing there would be insufficient food there to quell the practical appetite of the fraternity, a half the side of a raw pork was acquired from a nearby hotel. The half pork, married couples, a grass widower and a glorious-in-his-exception batchelor drove, or rather skidded and slid, on the icy roads through the moon- and discharge-lamp-lit country side to the rendezvous. There, the domestic staff had declared a sleep-in strike hours before; but out spoke one of the party, a man of Norman descent, saying he would be their saviour as he was a heaven-sent cook. His touch was professional; his sauce piquant; and his countenance delightful, with cooking uniform of embroidered tea-cloth around his neck and boiled shirt front. Festive was declared the repast, and happy the throng; and only a spoon—literal, please—was missed by the host when his friends had departed.

This advertisement is to acknowledge the return of the spoon some days later by the conscience-stricken collector—which exonerates the suspected "Marksman." As the host's cutlery bears his initial very deeply engraved, an awkward situation was saved. "MARKSMAN."

# The New Foundry of David Brown & Sons (Hudd.), Limited

## WITH SPECIAL REFERENCE TO THE RANDUPSON PROCESS

By VINCENT C. FAULKNER

It became evident to the directors of David Brown & Sons (Hudd.), Limited, during 1935, that the construction of an entirely new foundry was desirable on the grounds of increased requirements by their engineering shops and the lack of space for expansion at their Park Works. A 27-acre site was, therefore, chosen at Penistone.

This site was formerly occupied by Cammell Laird & Company, Limited, and the largest of the original buildings, this having an area of 100,000 sq. ft., still remained. The location presented many advantages, since it is only 14 miles from Huddersfield, and is connected by sidings with the Sheffield to Manchester and Sheffield to Huddersfield main-line railways. The shop, in its present appearance, represents almost the ideal construction for the prosecution of foundry work. It is composed of three bays; the centre one being 90 ft. wide by 560 ft. long. There is a side bay 58 ft. 6 in. wide by 280 ft. 6 in. long; and a third bay, which contains the offices, 53 ft. by 550 ft. long. It is a particularly high shop, being 57 ft. to the eaves and 67 ft. to the ridge. Since the roof is entirely of glass, the light during the daytime is excellent. Following modern-day construction, the walls are of asbestos sheets, which makes extension particularly easy.

The existing buildings cover only a small portion of the site and there is ample room for future extensions.

A special scheme of artificial lighting was got out, and this is controlled to give a minimum of 10-ft.-candles in any portion of the shop, with a maximum in certain areas of 13 ft.-candles. Special attention has also been given to maintaining an equable temperature throughout the shop at all times, both for the health and efficiency of the workers, and to secure the best results from the special moulding process which is used. The shop temperature is maintained between 55 and 60 deg. Fah. at all times by means of an oil-fired steam boiler plant, connected to a series of Mather & Platt unit heaters, suspended some 10 ft. from the ground level. Despite an all-glass roof, working conditions in the hottest summer months are extremely pleasant, due to the height of the shop.

The general lay-out of the shop is shown in Fig. 1, and, from the examination of this, it will be seen that it lends itself very well to any schemes of mechanisation which may be later installed.

### The Iron Foundry

It is about 12 months since the first cast was made in this shop, and during the intervening period the output has gradually risen, until at the present time it has attained the level of about 70 tons per week.

The construction of a new foundry during the period of relative prosperity had a profound influence on the choice of the process to be undertaken. Under such conditions, there is obviously a shortage of skilled men, and, since Penistone is in a comparatively rural area, the supply of skilled men is further limited. Penistone is also a scheduled distressed area, and it was desirable to do as much as possible to relieve the acuity of unemployment amongst workers who had no previous experience in foundry work. Since the requirements of the Park Works for iron castings are in general of a complicated and now repetitive type, which are usually moulded by dry sand moulding, the Randupson process of moulding commended itself very favourably for this work. Moreover, as steel castings are also required, this process permitted the manufacture of the two types of castings by an almost exactly similar process.

Raw materials arrive by rail and are shunted from the sidings by a locomotive jib crane and thence to the stockyard which is situated under a 5-ton gantry crane, which is provided with a magnet for handling pig-iron and scrap direct to the stockyard or the cupola stage; with a grab bucket of the pronged type for handling the coke to storage or to the cupola stage, and by grab bucket of the full closing type for handling the sands into their respective bins, which are situated adjacent to the cupola stage, the tops being level with this.

The melting plant consists of two Balanced

VIEW OF FOUNDRY BUILDING FROM RAILWAY SIDING.

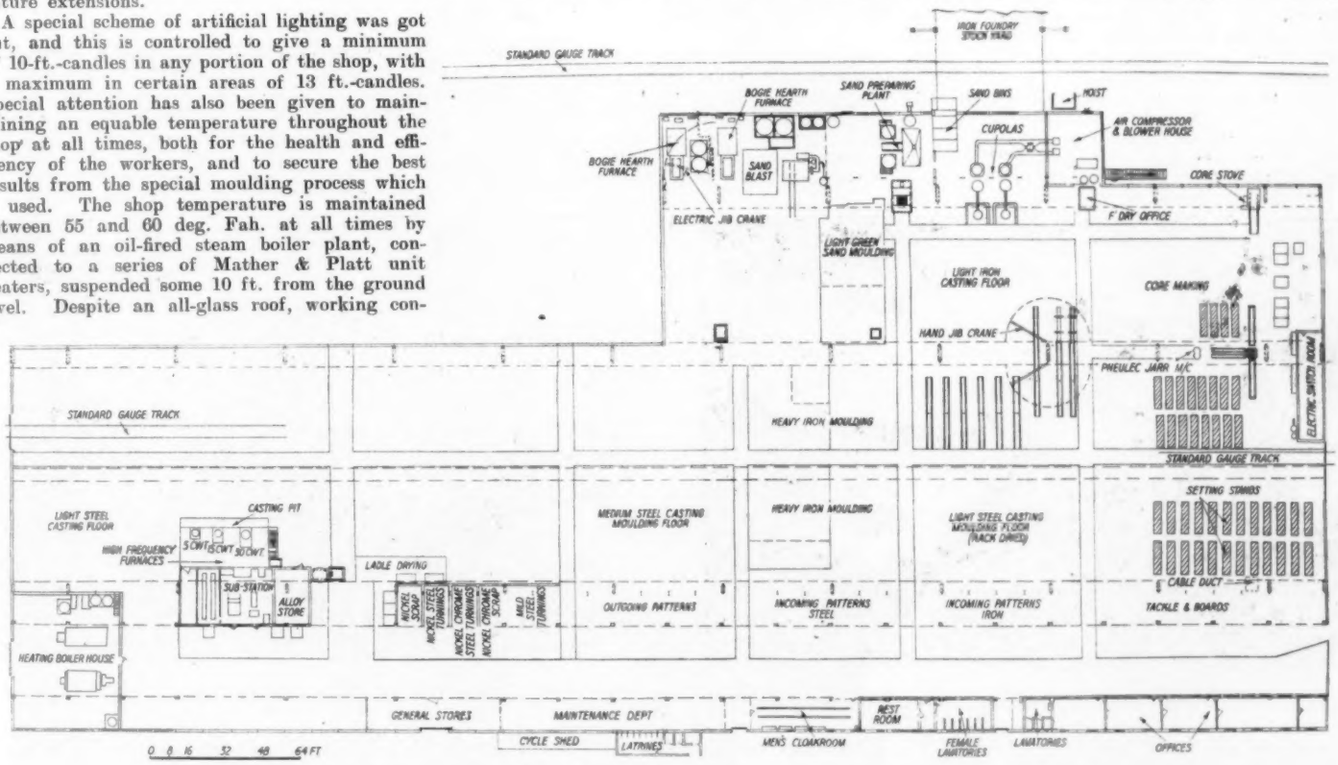


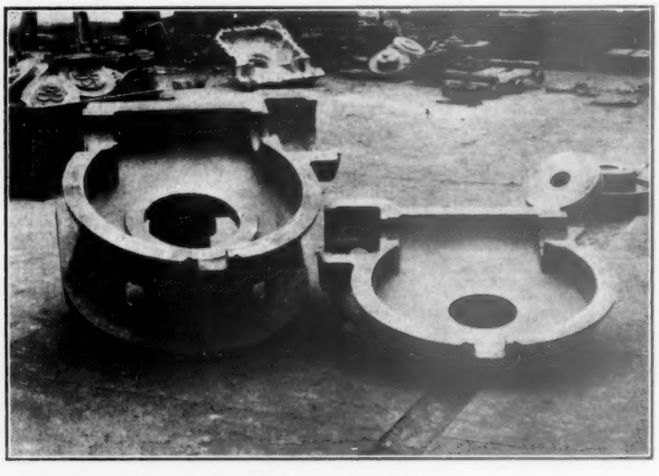

FIG. 1.—THE GENERAL LAY-OUT OF THE NEW PENISTONE FOUNDRY OF DAVID BROWN & SONS (HUDD.), LIMITED.

Blast cupolas with capacities of six and five tons per hr. respectively. Both are provided with receivers, as it is the belief of the management that this enables one to produce low total carbon cast iron with greater ease and with more regularity than the non-receiver type. The receivers are not provided with any auxiliary heating, nor do they tilt. The Pneulec Company of Birmingham were responsible for the construction of the cupolas. The metal is handled by ladles, suspended from the cranes.

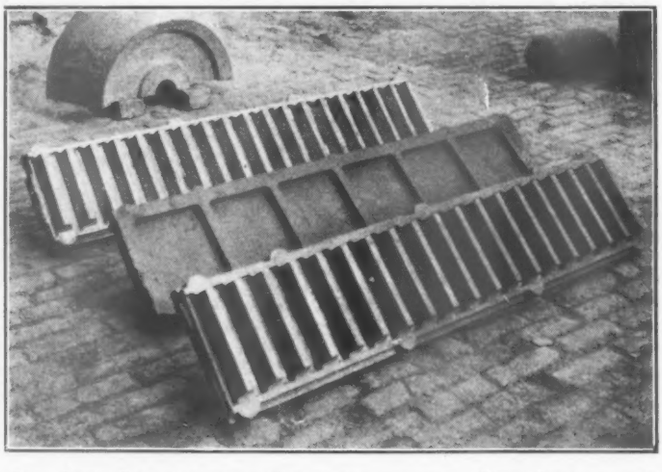
At the moment the central bay is spanned by two cranes of 20 and 5 tons capacity, and two similar cranes serve the side bay. However, three more cranes are at present on order, and it is intended to instal one which will be provided with a swinging arm, in order to transfer material from the central to the side bay or *vice versa*.

STANDS HOLDING SETTING RACKS LOADED WITH HALF MOULDS.

MOULD FOR H-ARM CAST STEEL GEAR WHEEL SHOWING TOP HALF ABOUT TO BE LOWERED INTO PLACE. A TYPICAL EXAMPLE OF THE "ALL-CORE" METHOD.



WORM GEAR CASES MADE IN CEMENT-SAND.



CAST STEEL RACKS MADE BY RANDUPSON PROCESS. NOTE STRAIGHTNESS AND TRUTH.

### The Randupson Process

The Randupson Process of cement moulding, which was developed at Ugine, a town pleasantly situated on the slopes of the French Alps, differs essentially from the normal dry sand process, in so much as the drying of the mould is not effected by the evaporation of the moisture but by definite chemical reaction. This fundamental difference reflects itself in the exhibition of an entirely new technique of moulding. For instance, no metal box parts are used, and the importance of correct ramming is greatly diminished, for, whether the face of the body of the mould is rammed hard or soft, it will, after setting give a surface entirely resistant to metal. The permeability of the mould is such that it never can possibly present any difficulties, being very much higher than is normally experienced in the more orthodox practice. It is easy to blow tobacco smoke through the mould material when set.

The sand used consists of silica sand, of suitable grading as regards sieve analysis, mixed with from 8 to 15 per cent. of cement and 4 to 10 per cent. of water. The mixture is varied to some extent, depending upon the nature of the castings to be produced, and the type of the mould being made. For iron castings, the whole mould made consists entirely of sand which has been used previously, except that it may be desirable on complicated castings to use a new sand for a portion of the facing to secure better finishing with the usual moulders' tools. The old sand is made from previously cast moulds, pulverised, remilled, and the requisite quantity of cement and water added. After a cast, the cast-up moulds are taken to a knock-out grid adjacent to the fettling shop and the castings stripped.

The now hard mould material is passed through a 6-in. grating, where it feeds itself into a crushing mill of the swinging hammer type, the pulverised material then passing into a boot of a 38 ft. high bucket elevator, where it discharges on to a "Rapid" type of magnetic separator, and from thence on to a "Rotex" vibrating screen. This rejects all material above a certain size back to the pulveriser for re-crushing, and takes out all the silt and fines from the

sand. The screened sand then passes on to a conveyor band which feeds the sand into a 60-ton hopper, which is placed directly over a skip hoist, feeding either of two August Simpson mills. The material in the skip-hoist is here supplemented by additions of cement, and water is added in the mill through a meter. The complete cycle of mixing takes only 2½ min. for each load. The complete sand preparing plant was erected by August's, Limited, of Halifax. The designs were prepared by them in conjunction with David Brown & Sons. Dust extraction takes place at three points, which keeps the atmosphere round the plant in excellent condition. The loss of sand due to screening out of silt and fines amounts to about 7 per cent. of the moulding sand crushed. The mills are provided with a bottom discharge at a suitable height to fill "Jubilee" trucks for transferring the prepared sand to the moulders. Wherever possible for the Randupson process, it is advisable to have split patterns to facilitate mounting these on boards surrounded by wooden frames, which replace moulding boxes. At the same time, strickling and bedding in are just as easily performed with the Randupson process as with the more usual methods, but it is to be remembered that the sand as prepared for moulding contains little bond and will not lift well. Where split patterns are used, these are mounted on boards, and auxiliary patterns for runners and risers are in every case mounted with them so that no discretion is left to the moulder in these directions, and no variation from standard practice is possible.

There are, of course, many other points of technique in the Randupson process, which have been developed in the foundries of the inventors over the last five years, both as regards the actual moulding sand and its treatment, and the correct methods of employing it, and improvements are constantly being effected due to interchange of experience among licensees throughout the world.

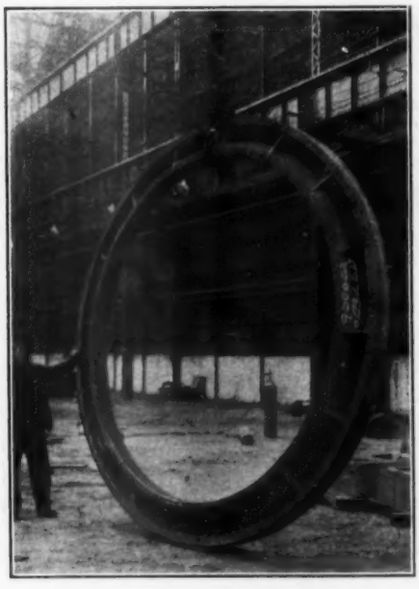
At the moment there is only one moulding machine installed in the foundry, and this is a Herrmann Pneulec jar ram turnover machine taking boxes up to 4 ft. 6 in. by 4 ft. This machine is turning out an average of 85 moulds per day. The moulds from this machine are passed down a roller conveyor on their wooden boards, and like all other moulds, are put on racks. These racks, containing six to twelve half moulds, are then stacked on special stands for setting.

These are clearly shown in one of the illustrations, and the unique roller arrangement shown at the ends of the racks allows of the loading of these by the overhead cranes. The time for setting, being a matter of chemical reaction, varies with the mass of the mould, but even in the largest moulds two days is quite adequate, and in many cases 24 to 36 hrs. suffices. If the moulds are to be used for cast iron, then they are blacked, and the drying of this blacking requires an extra 12 to 24 hrs. Obviously, it would easily be possible to instal stoves

CORES FOR LARGE CAST-IRON WORM WHEEL BLANK SHOWN IN ANOTHER ILLUSTRATION.

MEDIUM SIZED MOULDS ASSEMBLED AND CLAMPED FOR CASTING.

SAND-PREPARING PLANT CONSISTING OF TWO BOTTOM DISCHARGE AUGUST SIMPSON MILLS FED BY SKIP HOIST, WHICH IN TURN IS FED FROM OVERHEAD RECOVERED SAND HOPPER.



LARGE CAST-IRON WORM WHEEL BLANK MADE IN CEMENT-SAND BY THE "ALL CORE" METHOD.

for the purpose of carrying out this chemical reaction, but this would naturally add to the cost of the process.

The moulds are inclined to expand very slightly on drying out, but this is insufficient to cause any serious dimensional difference from the actual pattern, and experience has shown that with the Randupson process, due to the greater rigidity and hardness of the moulds, castings much truer to pattern are obtained, and in castings such as large gear cases the difference in flatness of the sides and truth of the ribs between those made by the Randupson process and those made by the usual methods is very striking. Cellulose paints are used for the patterns since ordinary varnishes are attacked by the damp cement, and thus warping of the pattern would occur if the bare wood was exposed to the influence of damp sand. The moulds are reinforced by the insertion of mild steel straight rods, varying from ¼ to ⅝ in. in diameter according to the size of the mould, and the strength of the material is such that less sand need be used than with ordinary practice. Staples are bedded in the large cores and moulds for lifting purposes.

VIEW OF CORE-MAKING SECTION FROM TOP OF SAND-PREPARING PLANT. PORTION OF MOULD ASSEMBLY FLOOR IN BOTTOM RIGHT-HAND CORNER.

TYPICAL CAST-IRON HALF WHEEL CASTINGS FOR DOUBLE HELICAL GEARS MADE IN CEMENT-SAND BY THE RANDUPSON PROCESS.

At first sight it looks a little remarkable to see heavy moulds being cast without being encased in iron boxes, but no cases of "break outs" have yet been experienced. Each mould carries in distinct lettering a number taken from a large sign prominently exhibited. This number is advanced by one unit each day, Saturdays and Sundays included, and affords ready information as to exactly how long each mould has been made, though experience of the process will give this information after visual inspection of the moulds.

With the exception of the smallest and most complicated cores, it is usual to make the cores from the same material as the moulds, and a large amount of these and all the small cores are made by female labour.

### Closing the Moulds

The moulds, after setting, are removed, rack at a time, by overhead cranes from the setting stands. These racks fit into special gravity roller conveyors, and the bottom halves are slid along these on to casting racks, and the top halves are lowered on. Registration is effected by the cup and cone system, which has previously been detailed in these columns when describing the foundries of Kryn & Lahy. The necessary parts being put on the patterns by the pattern-makers, the two halves of the mould are then clamped together by special quick acting clamps which can be clearly seen in one of the illustrations. The runner and riser bushes are made of the same sand and a large stock of these is kept in hand.

### Steel Foundry

The steel foundry has only been in operation for about a month, and from examination of the castings, so far made, wonderful progress has been realised. Not in every case is the surface of the casting of the highest order, but there is every reason to believe that, within a very short space of time, practically perfect surfaces will be produced under all conditions. One of the claims of the Randupson process, which has been demonstrated in other countries, is that on steel castings a smoother and better surface is obtained than with the normal methods.

It seems germane here to remark that the entering of small amounts of impurities, due to oil-sand mixtures, or indeed ordinary floor sand, does not apparently affect the efficiency of the process; but, obviously, too much liberty should not be taken. For steel castings a facing sand is used on account of the higher refractory properties needed. This must consist of silica sand with the requisite amount of cement and water, but the backing sand is the same as that used for iron castings. After setting no further facing of the moulds is needed and this leads to important economies both in time and labour, and in certain cases can lead to great cheapening of the pattern construction and method of moulding employed.

The steel-foundry moulding plant consists of three high-frequency electric furnaces of 30 cwt., 15 cwt., and 5 cwt. capacity. For their operation, a 550 kilowatt generator is installed which allows of the use of the largest furnace by itself, or the two smaller ones working together. The furnace bodies are fitted with the latest type of hydraulic lip tilting gear, which gives very smooth operation. The complete melting unit, including generator house and air conditioning plant, was erected by the Electric Furnace Company of London. All castings are annealed or heat-treated in a bogie-hearth electric furnace of 150 kilowatt rating, made by the Birlec Electric Furnace Company. Adjacent to the furnaces are installed oil and water quenching tanks, each fitted with suitable cooling coils.

### Patternshop

At the present time the patternshop is housed in what was the generating station when the works were operated by Cammell Laird & Company. Half the shop is below ground level, which does not make for easy transport, and erection has now been started on an entirely new building, 120 ft. long by 130 ft. high, for the better housing of this department. The shops are particularly well equipped with all

INTRICATE MACHINE-TOOL BED CASTING MADE IN CEMENT-SAND BY THE RANDUPSON PROCESS. THE MATERIAL IS NICKEL-CHROME-MOLYBDENUM CAST IRON MELTED IN THE HIGH-FREQUENCY FURNACE.

types of woodworking machinery down to electrically heated glue pots.

A large single storey building, 300 ft. by 120 ft., has been erected for the storage of patterns. This is situated well away from the actual foundry, in order to take advantage of the lower fire insurance rates thus obtainable.

### Laboratories

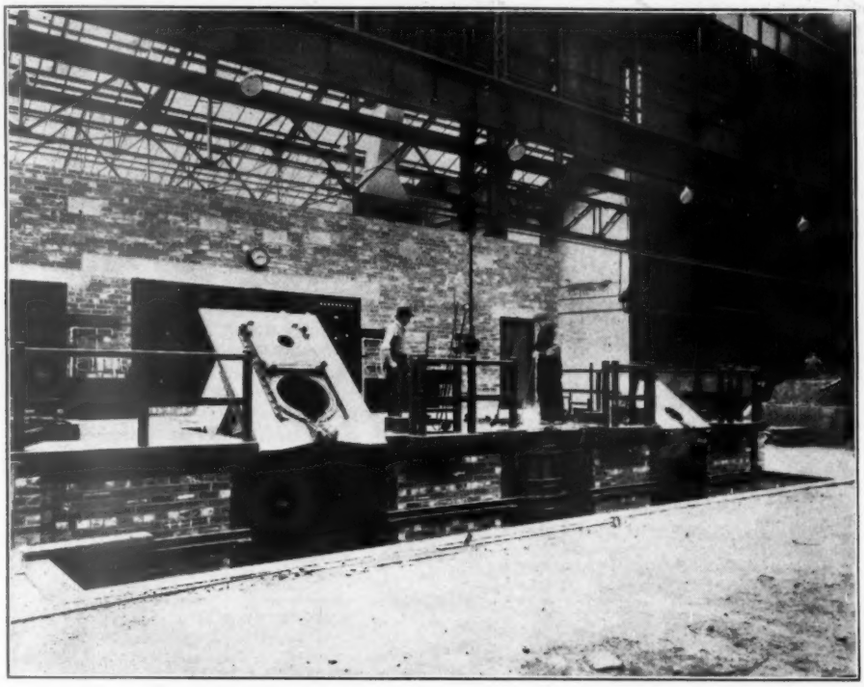
At the present time the laboratories are situated at the main works at Huddersfield, but new laboratories are being erected at Penistone, and it is hoped to make these the most modern of their type, and they will probably include a 300 k.v. X-ray plant for the non-destructive examination of light iron and steel castings.

Every phase of welfare is undertaken by this concern, starting with the psychological examination of candidates for employment to the provision of a gymnasium for the apprentices. Actually, this department is centred at Huddersfield, which is not too far removed from Penistone, to allow of the participation in its activities by the employees in the new foundry. These welfare activities are so much appreciated locally that no dearth of apprentices has been experienced, but rather, on the other hand, there is always a long waiting list to join the company.

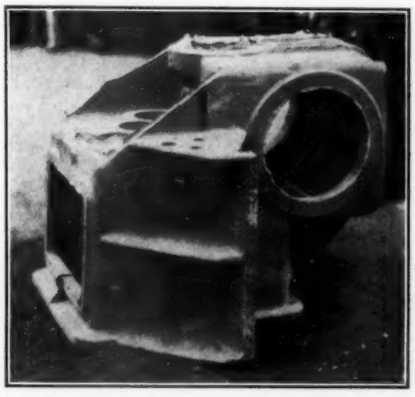
### Conclusions

It would be invidious to comment on the actual construction and operation of the foundry itself, and the concluding remarks will therefore be confined to the Randupson process as being of very great interest to the foundry trade as a whole. Dealing first with its disadvantages; first, there is the obvious one of the time factor, as the moulds all require two to three days for setting and blacking in the case of cast iron and two days in the case of steel, but this disadvantage becomes less apparent where really large castings are being made, because of the less time required for the ramming up of the moulds. The main advantage of the process is the reduction in actual moulding costs. Other advantages, which are obvious from an inspection of the process, are the complete elimination of any defects which can be attributed to the lack of porosity in the mould, as the Randupson process gives to the foundry industry the material of which porosity is so great that the evacuation of gases from a mould can never constitute a real problem. To our mind, an equally great advantage is that the system transfers, in a very large measure, the technique of moulding from the hands of the skilled men to the executive officers of the company.

The refractoriness of the mould material is at present definitely adequate for all types of bronze, cast iron, and most steels, but for making castings of the 18: 8 stainless variety, the refractoriness would have to be enhanced by the incorporation of such materials as chromite in the silica sand. Its commercial sphere seems to be definitely in the direction of replacing the old dry-sand moulding system. It does not appear to be sufficiently commercially advantageous to compete with green-sand moulding for light castings, especially when these are made on a mechanised system. Its very special field is where major shop extensions are envisaged, or a new foundry is to be created, because in well established concerns, its installation would mean the obsolescence of important quantities of existing plant, such as stoves, moulding boxes and general foundry tackle.



HIGH-FREQUENCY MELTING UNIT COMPRISING 30-CWT., 15-CWT. AND 5-CWT. BODIES ENERGISED BY A 550-KW. MOTOR GENERATOR.



INTRICATE LOCOMOTIVE GEAR BOX CASING, MADE BY THE RANDUPSON PROCESS.

Because knocking-out is centred in one particular position in the foundry, a reasonable amount of mechanisation could be adapted to reduce transport costs.

The handling of the sand, until the skin gets used to the roughness of the silica sand grains, is inclined to cause a slight abrasion of the finger tips, and of the dozen or so girls employed in the core shop, about two (the latest recruits) are still wearing rubber gloves. It is found, however, that, within a very short space of time, the skin gets used to the handling of this material. The shop definitely gave us the impression that the dust problem was less in evidence than in an ordinary foundry.

Finally, the author extends his very sincere thanks to David Brown & Sons (Hudd.), Limited, for affording him the facility for inspecting this foundry, and especially to Mr. F. W. Rowe, B.Sc., chief metallurgist of the company, who is also in charge of the Penistone Works, for his courteous reception and help in the preparation of this article.

[A letter on the subject of this process appears on page 103.—EDITOR.]

## Publication Received

**Tentative Definitions of Porcelain Enamel Terms.** Published by the Porcelain Enamel Institute, 612, North Michigan Avenue, Chicago, Illinois.

A large amount of literature is being built up in both English and German on the subject of vitreous enamelling, and nothing is so helpful to correct translation as the existence of clear nomenclature, illuminated by exact definition. For the English language, this brochure has done a remarkable service, and we suggest that it would help the exchange of knowledge internationally if the German enamellers' association would effect an annotated translation. Controversial terms such as "acid proof" and "acid resisting" have been omitted, but "acid resistant" has been included and defined as "resistant to acids, not necessarily stain proof, should be considered resistant if the surface is but slightly affected and the enamel is not rendered chalky."

Between eighty and ninety terms have been defined. Well knowing the generosity of American technical institutes, we feel sure that anyone writing to America for this brochure will not be disappointed.

## Catalogue Received

**Pig-Iron.** The Low Moor Iron Company, Limited, of Lincoln House, High Holborn, London, W.C.1, have sent us a well produced catalogue dealing with Lowmoor C.B. genuine cold-blast pig-iron and Denby semi cold-blast pig-iron as related to the roll industry. It is well illustrated with views of Glanmor, Llanelly, Tennent's, Brightside's, Akrill's, Perry's, Johnson's, Taylor & Farley's and Nevill's shops, either the foundry or the roll turning shop being shown. An impressive picture of a train load of chilled rolls made by John Lysaght is included. Analyses of the two brands are given on page 20, whilst on page 24 is an illustration of a bar taken from the front of one of the original blast furnaces carrying the inscription H. J. D. & H., 1790. The initials represent the names of the first partners in the Low Moor Iron Company—Hird, Jarratt, Dawson and Hardy.

## West Yorkshire Foundrymen's Annual Dinner

The annual dinner and dance of the West Riding of Yorkshire Branch of the Institute of British Foundrymen was held at the Victoria Hotel, Bradford, on January 16. Mr. Joseph Hepworth, M.P. (Branch-President), presided, and among those present were the Lord Mayor of Bradford (Alderman G. R. Carter) and the President of the Institute (Mr. Harry Winterton).

Proposing the toast of "The Visitors," the BRANCH-PRESIDENT said that members of the Branch were doing their best to carry on the good work of the Institute, and they could all look forward to the coming year with very much interest from the business standpoint. He was confident that they would find at the end of 1937 that they had every reason to be grateful for a material improvement in their trading conditions. In industry generally the home trade was undoubtedly making great progress and though the export trade was not keeping pace with it, the latest figures showed signs of some improvement. He believed that they had ample reason to hope that 1937 might prove to be a record year.

The LORD MAYOR OF BRADFORD, responding to the toast, said that he was glad to find that the President was optimistic in regard to that section of the engineering industry, which for some time past had required special attention. As a member of the Yorkshire Council for Further Education, he had served on a committee appointed to deal with the heavy engineering industry, which some time ago set up a course of studies for foundrymen which had been circulated to all the technical colleges in the area. There were on that committee men, such as Mr. W. Slingsby, who were thoroughly acquainted with the foundry industry, and who were well satisfied that if the advice of the committee was acted upon there would be sufficient effect to induce to go into the foundry industry young men of a type which had not been forthcoming for some time past. He hoped that, as a result of the study of the needs in the educational world, that industry was going to be more attractive than it had been to young men who were seeking a profession to follow. He did not see any reasons why this section of industry should not be attractive to the right type of boys if they were adaptable and studious and would take advantage of the facilities which were provided and if employers would see that they took advantage of opportunities of that kind. He hoped that, as a result of the activities of the Institute in that district and elsewhere, this industry would prosper more than it had done in the past.

### The Bradford Conference

He was told that the annual conference of the Institute was to be held in Bradford next year. He was very glad to find that Bradford had been thought to be of sufficient importance for the conference to be held there, for he had thought that it was generally held in larger cities such as London, Manchester, Sheffield, Glasgow and Birmingham. All such bodies as the Institute of British Foundrymen might be sure that when they came to Bradford for conferences, the Bradford people would be found very willing at all times to make a success of a conference; if only because they were thankful for all that other people attempted to do for their benefit. He sincerely wished them every possible success in their work.

MR. HARRY WINTERTON proposed the toast of "The West Riding of Yorkshire Branch." He said he felt that any remarks that he might make would fall upon ears which would already have been attuned to some of the finest sentiments which it would be possible to hear expressed at any public dinner. Those of them who were in the foundry industry were all extremely glad that after so many years of depression they were once more beginning to exercise their energies in the right direction. The ordinary foundryman was not particularly interested in politics, and only felt that so long as the country kept out of war and occupied its time and attention in providing ploughshares, they need not be anxious to provide spears. There was no trade which was more disposed than the foundry industry towards the maintenance of the peaceful position of this land of which they were all so proud. As President of the Institute, he would like to say how much he and all his colleagues valued the work that was being done by the West Riding of Yorkshire Branch, under the leadership of the President of the Branch and his colleagues, especially Mr. S. W. Wise.

One point which had been noted with great pleasure by the General Council of the Institute was the fact that the West Riding Branch was working all the time for the benefit of the younger generation. Their success in that respect was particularly appreciated, and the systematic way in which educational opportunities were placed before the younger people by that Branch was appreciated by all the members of the Institute. It was worthy of note that this was one of the Branches of the Institute which possessed its own library. The extension of that idea might very well be carried out by other Branches of the Institute. The services of the Technical College at Bradford were well known also. A point that was worthy of mention was that they catered very much for the practical man, and in that connection their visits to works were always most interesting.

MR. H. FORREST, replying, thanked Mr. Winterton for his kind references to the work of the Branch, and said they did their utmost to make the work of the Branch successful.

In response to the Branch-President, MR. S. W. WISE said the success of the Branch was due to the cordial co-operation of the members. Without such co-operation a secretary was helpless. The Branch stood second to none in regard to its attendances at the meetings every month. Although the members were located in such a widely scattered area, there was an average attendance at the meetings of at least 40 per cent. That was a record of which any technical institute might be proud, and it was entirely due to the loyalty of the members.

## Air-Compressor Control

### ECONOMY ON LIGHT LOAD

A new control device, which has been provisionally patented by J. Browett Lindley (1931), Limited, Letchworth, Herts, has been designed for use with one of the firm's standard control systems in order to obtain economical and cool running of air compressors where high pressure or long periods of light load occur. In the case of a plant with a delivery pressure of 300 lbs. per sq. in., the delivery pressure is kept within fine limits by an automatic inlet control device of normal design, but without special precautions, the air trapped in the high-pressure cylinder would continue to be compressed to nearly 300 lbs. per sq. in. at every revolution, with consequent wastage of power and danger of overheating.

Fig. 1 shows the simple manner in which this difficulty is overcome. C is a standard relay valve loaded by the weights D and supplied by compressed air from the outlet side of the compressor through the grit strainer B. When the delivery pressure reaches a predetermined limit, the valve is able to overcome the weight D, thus uncovering a port and admitting air to the pipe K through which it passes to close the governor valve E. This is so far standard practice, and the improvement consists of an extension of the governor valve spindle to form a further relay valve F, which enables the compressed air to pass along a pipe to the space between two opposed pistons H, H after the inlet valve has been closed. These pistons are connected to prongs, which act directly on the suction plates.

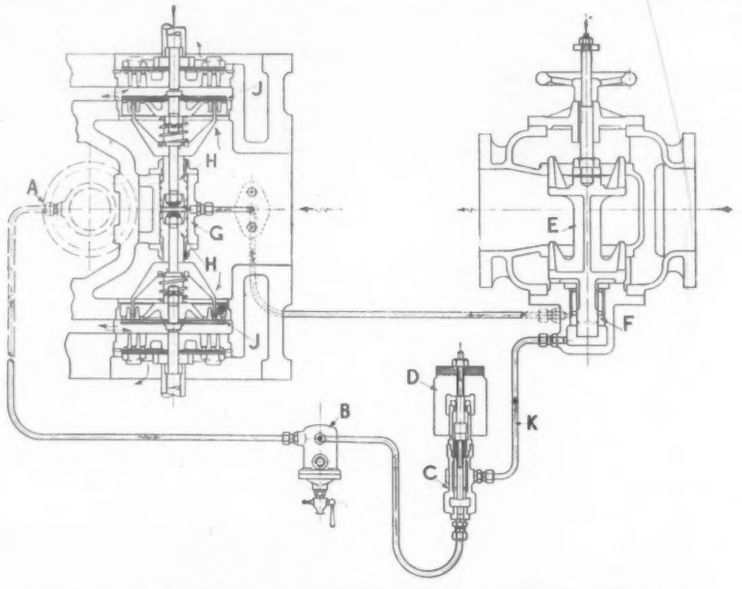



FIG. 1.—SECTIONAL VIEW OF PATENTED AUTOMATIC RELEASE DEVICE.

A=Final discharge pipe. B=Grit strainer. C=Main relay valve. D=Weight for C. E=Inlet control governor valve. F=Relay valve for operation of high-pressure unloading device. G=Control cylinder inside high-pressure cylinder. H,H=Opposed pistons in G. J=Suction-valve plates. K=Pipe for conveying air from main relay valve to inlet control governor.

Hence the air left in the high-pressure cylinder, instead of being compressed to within a few pounds of the outlet pressure at each stroke, is compressed only to the pressure of the intercooler, thus effecting a considerable power reduction when the motor is running on no load, and eliminating the possibility of overheating. The fact that this method of control has a minimum number of parts and that it is entirely automatic, enables it to operate indefinitely without attention, once the initial adjustments have been made.

# Lord Austin on Foundry Practice

## A MAJOR FACTOR IN PROFIT AND LOSS

MR. G. W. BROWN (Branch-President) occupied the chair at the annual dinner of the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, which was held in Birmingham last Saturday.

LORD AUSTIN, in proposing the toast of the Institute of British Foundrymen, spoke of the value of the Institute's work in advancing and improving the trade its members followed, and said in the industry with which he was connected the foundry was a very important section. Although great strides had been made in the mechanisation of the foundry, it remained one of the places relying to a great extent on hand labour. Foundry work was a type apart. Not only had the man to have the skill of a craftsman; he also required the strength of a navvy—a difficult combination to obtain. For reasons he had never been able to understand, the foundry had always been the Cinderella of of the engineering trade, yet there was no other department where either such large profits or losses could be made.

Lord Austin said the first foundry over which he had control was in Melbourne, Australia, soon after he had finished his apprenticeship. That was forty-five years ago, and, although since then many improvements had been made, the foundry was still much behind other departments. He said that with a certain amount of fear, but he did not think it was the fault of the foundryman; he thought it was the fault of the financier or the engineer, who had not appreciated as he should have done the big things which were to be gained in a well-organised, well-equipped, well-run foundry.

During the past twenty-five years the chemist and the metallurgist had both added greatly to the work done by the foundry, but there remained the dust, smoke and heat. Most of these troubles were unnecessary and could be removed. In his experience the biggest advances were not always at foundries connected with engineering works, but in the specialised foundries.

### Importance of Training

Lord Austin suggested that the right kind of men must be trained for foundry work which was one of the oldest crafts in metal work, and he said they must go on improving conditions until the foundry lost much of its terror and attracted the type of men needed. He emphasised the importance of good training for youths as likely to produce better results. At his works at Longbridge they were making efforts in this way to bring up a considerable number of apprentices, giving them opportunities to learn, bringing them forward and adopting them into the organisation as opportunities arose. That was one of the ways in which he thought industry generally throughout the country would have to proceed in future. The introduction of special alloys had brought new problems for the foundryman as well as a new science and an added interest.

Recalling that the foundation of the Institute was laid in Birmingham in 1904, Lord Austin said there were seven people at the first meeting, and he was pleased to know that one of that number, Mr. F. J. Cook, was present at the dinner. The outcome of the first meeting was the British Foundrymen's Association, the forerunner of the Institute. To-day the Institute had fifteen Branches and some 2,000 members, of whom the Birmingham Branch had over 300.

Lord Austin said Birmingham now had an important position in the industrial sphere to-day, and he thought it was likely to occupy a very much bigger place in the future. One would be quite certain in assuming that the growth in Birmingham would be considerably greater than any industrial town in the Empire.

He felt sure the Institute would grow in numbers and usefulness. There was, relatively, much more valuable work to do in the future. Industry was continually finding new ways to employ the craft of the foundry. Nowadays the forge shop was in keen competition with the foundry, but, of course, it had its limitations, whereas there was scarcely any limitation in the application of castings. He did not suppose there were any works that had seen more of that competition than was to be found at Longbridge. It was a very healthy rivalry.

### Encouragement Needed

MR. H. WINTERTON (President of the Institute), responding, said the Institute was taking great care of the technical side of the work, especially from the point of view of the younger members. The Institute realised that the foundry had been the Cinderella of the engineering industry, but he felt that presently it would become a more important section of the trade.

MR. E. J. FOX, managing director of the Stanton Ironworks Company, in proposing the toast of "The Birmingham, Coventry and West Midlands Branch," referred to the work Birmingham and Sheffield Universities were doing to support the technique of the foundry industry, and said he thought it was the duty of all interested in the production or use of pig-iron to do anything they could to support this great basic industry.

He said that the foundry industry required a little more encouragement than was realised. The iron-foundry industry was in competition with alternative materials, with non-ferrous metals and with steel fabricated materials, and it required all the technique the industry could possibly put forward to maintain the position of the industry, which was a great fundamental section in engineering.

MR. G. W. BROWN, Branch-President, in his reply, paid a personal tribute to Lord Austin, and spoke of the high esteem in which he was held at his works. Lord Austin had given considerable attention to the development of the foundry, and was one of the pioneers in the application of mechanical help to the foundry.

MR. BROWN expressed the view that it was the combination of the foundryman, the metallurgist and the electrical and mechanical engineer on which the future of the foundry industry rested, and it was only by whole-hearted co-operation that success could be attained.

The toast of "The Guests and the Ladies" was given by MR. G. T. LUNT and acknowledged by MRS. G. W. BROWN, after which there was dancing.

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(*Concluded from next column.*)

scheme over a period, during which time an adequate technical service is available for the licensees.

David Brown & Sons have been kind enough to agree that, subject to certain reasonable conditions, their progress with Randupson can be seen at Penistone by licensees and those who are convinced that their class of work is suitable for cement moulding.

The writer will be very pleased indeed to give all the information and help he can to interested founders if they will communicate with him in Sheffield, mentioning in their first communication some details of the types of castings they are making. It is hardly necessary to say that the information so given will be treated in confidence.—Yours, etc.,

G. P. HINCKLEY.

Hinckleys, Limited,
11, East Parade Chambers,
East Parade,
Sheffield.

# Correspondence

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

### Vitreous Enamelling in Germany

*To the Editor of* THE FOUNDRY TRADE JOURNAL.

SIR,—I have noted with interest the article under the above title appearing in your January 7 issue, being the Paper read at the last meeting of the London Section of The Institute of Vitreous Enamellers. Dr. H. J. Karmaus seems to be a strong advocate of substitutes for various products used in enamel batches, and I strongly agree with the remarks of various speakers at the meeting to the effect that this craving for "substitutes" is due to present conditions in Germany, resulting from the lack of adequate foreign currency.

With particular reference to the proprietary article said to be a substitute for borax, it is within my knowledge that, notwithstanding encouragement given by the authorities, the quantity of this product used in Germany is still quite negligible. At any rate, much more borax is employed in Germany now than ever before, more especially in the vitreous enamelling industry, in spite of the great difficulties which have been experienced in providing requisite foreign currency. Borax is referred to in the Paper as "relatively expensive," but the fact is that borax still costs a good deal less than in pre-war days, notwithstanding heavy import duties.—Yours, etc.,

W. J. HATCHLEY,
For CLIFFORD CHRISTOPHERSON & COMPANY, LIMITED.

Shell-Mex House,
Strand, London, W.C.2.
January 13, 1937.

### Randupson Process

*To the Editor of* THE FOUNDRY TRADE JOURNAL.

SIR,—The description of David Brown & Sons' Penistone Foundry appearing in this issue refers constantly to the Randupson process for cement moulding, and, in view of the great interest which has been paid to this method of moulding by English ironfounders, we, as the sole concessionnaires for the United Kingdom and Northern Ireland, welcome this opportunity of making some additional comments.

The Randupson moulding process has been operating successfully in certain foundries in France for some years, but it is only recently that its suitability for foundries in this country has been recognised and stressed. Undoubtedly there is ample evidence of its value, particularly to those founders whose output is such that extensions or new foundries are necessary, as the speed and cheapness in which a new foundry can be started and operated on the Randupson method is remarkable.

Again, foundries whose chief output is of dry-sand castings, whether iron, steel or non-ferrous, can make astounding savings in their production costs. It does not appear to be of substantial advantage for green-sand castings, especially when these are made on a mechanised system, although we are assured that any foundry which adopts the process for its dry-sand work will be able to turn over their green-sand output to the Randupson process without disadvantage to themselves.

The main features of the process appear to be the elimination of expensive equipment, that is, drying stoves, moulding boxes, etc., and the possibility of using semi-skilled or, with a certain amount of supervision, unskilled labour. This is a very important factor just at present.

The system of marketing the process is quite simple and consists of an arrangement whereby a proportion of the savings effected by the founders are paid to the originators of the

(*Concluded in previous column.*)

# Production and Properties of Ni-Tensyl*

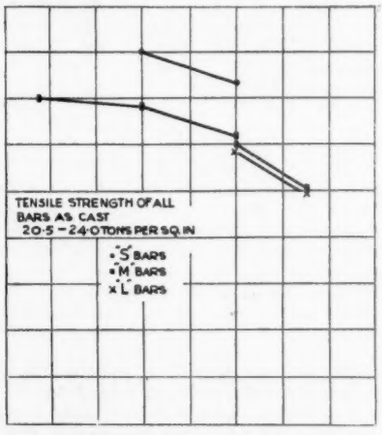
### Production of Ni-Tensyl

Ni-Tensyl combines a high strength matrix with a finely dispersed form of graphite. It provides engineers with a material which has a high strength, is readily handled in the foundry, gives sound castings of all types and involves no substantial increase in cost.

In outline, the production of Ni-Tensyl consists in first preparing a suitable base iron—a cheap, low carbon cast iron which would give white iron castings—and then inoculating this iron with nickel and silicon, as a result of which it yields grey iron castings, with the graphite in a finely dispersed form. This process is covered by British Patents 290,267 and 352,510.

The first step in production is the preparation of a base iron having the following recommended analysis:—T.C, 2.5 to 3.0 per cent.; Si, 0.5 to 0.8; Mn, 0.7 to 1.0; S, 0.12 max., and P, 0.2 max. per cent.

The methods employed for making up this base iron depend upon the melting facilities available. However, it is usually produced in the cupola, the charge including between 50 and 90 per cent. of steel scrap in a suitable form. Rail and girder croppings, heavy punchings and similar scrap are best; light punchings and light sheet clippings should be avoided. The balance of the furnace charge consists of Ni-Tensyl scrap, of scrap iron of known composition, or of selected pig-iron. Every care should be taken to avoid the use of irons with high phosphorus contents, so that this element may be maintained at the specified low figure. When charges of this type are melted under ordinary foundry conditions, the steel will generally be sufficiently carburised to give the desired carbon content.




[*By courtesy of S. Russell & Sons, Limited.*

FIG. 1.—GRAPH SHOWING STRENGTH OF NI-TENSYL AFTER OIL-QUENCHING FROM 850 DEG. C. AND TEMPERING AS INDICATED.

If rotary furnaces are used for making up the charge, a different procedure must be adopted, because carburisation presents certain practical difficulties. In this case the required carbon content is secured by the use of a charge consisting mainly of selected pig-iron, and although a certain small proportion of steel scrap is generally desirable, in order to adjust the carbon to the proper level, care must be taken to avoid excessive oxidation, with consequent loss of carbon.

Inoculation of the bath should take place shortly before the castings are poured. With cupola melting, the operation is usually conducted in the ladle or in a receiver after tapping; with rotary furnace melting, it can be carried out in the furnace immediately prior to tapping. The inoculation treatment consists of adding to the bath sufficient nickel and silicon to give effective graphitisation, the amounts depending upon the size of casting being made. It is found in practice that inoculated iron has a very wide latitude so that satisfactory results are secured in most cases by bringing the silicon content up to 1.25 or 1.75 per cent. and by adding about 1 or 2 per cent. of nickel. For general guidance it may be stated that satisfactory results have been obtained over a wide range of section thicknesses from a standard composition containing 1.5 per cent. of silicon and 1.5 per cent. of nickel.

The low carbon content and consequent short freezing range of Ni-Tensyl make it desirable to pour the metal as soon as possible after inoculation, and runners and risers should be amply proportioned. The tendency to tear during solidification prevents the use of rod feeding and the risers must therefore be large enough to ensure a self-feeding action.

Although Ni-Tensyl can be used for both large and small castings, its short freezing range necessitates the use of a higher carbon for castings which are small or which have light sections. On the other hand, special precautions have to be taken to prevent the cracking of very large castings during solidification, and in this case the adoption of steel casting technique is desirable.

### Properties of Ni-Tensyl

The outstanding property of Ni-Tensyl is its tensile strength, which usually reaches 25 tons per sq. in., as compared with a maximum of 18 to 20 tons per sq. in. for an alloy cast iron made under ordinary foundry conditions. Individual melts of Ni-Tensyl have given castings with strengths as high as 30 tons per sq. in. This high strength is, of course, of the utmost value in castings to be used for highly stressed items, such as machinery parts and flywheels, for which the strength of ordinary cast iron would be insufficient.

Another interesting feature of Ni-Tensyl is its relatively high hardness, due to the very fine and dense structure, resulting from the low carbon content and inoculation treatment. Hardness values as high as 280 Brinell have been frequently reported and yet the metal has proved easier to machine than ordinary cast iron. Its machining quality is, in fact, midway between that of ordinary cast iron and that of steel, and quite long curly turnings may often be obtained.

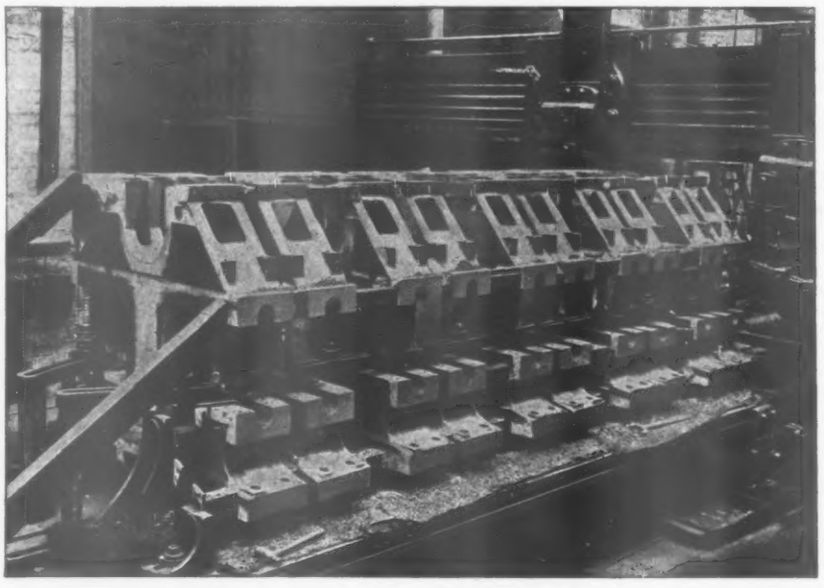
There is very little variation in the structure of thick and thin sections cast in Ni-Tensyl.

TABLE I.—*Repeated Impact Tests.*

| Material. | Actual transverse strength. (T.R.S. tons per sq. in.) | Approx. tensile strength. (Tons per sq. in.) | Repeated impact, blows to fracture. |
|---|---|---|---|
| Ordinary cast iron | 23.0 | 11.0 | 32 |
| Machinery cast iron | 28.3 | 15.0 | 163 |
| Ni-Tensyl | | | |
| As cast .. .. | 36.8 | 23.0 | 1,838 |
| Heat-treated to 302 Brinell .. | — | 33.0 | 2,817 |

With proper foundry technique, it also gives very sound, dense castings, eminently suitable for pressure work. The density and stability of Ni-Tensyl make it suitable for castings which have to resist wear and the effects of heat and corrosion.

Like other alloy cast irons, Ni-Tensyl is amenable to heat-treatment, and by applying a simple quenching and tempering operation strength figures of 30 tons per sq. in. and over have been obtained repeatedly in commercial castings. Fig. 1 shows some results obtained under practical foundry conditions, after oil-quenching and tempering bars of different sizes at different temperatures.



[*By courtesy of Mirrlees Watson Company, Limited.*

FIG. 2.—SUGAR-MILL HEADSTOCKS IN NI-TENSYL, REPLACING CAST STEEL.

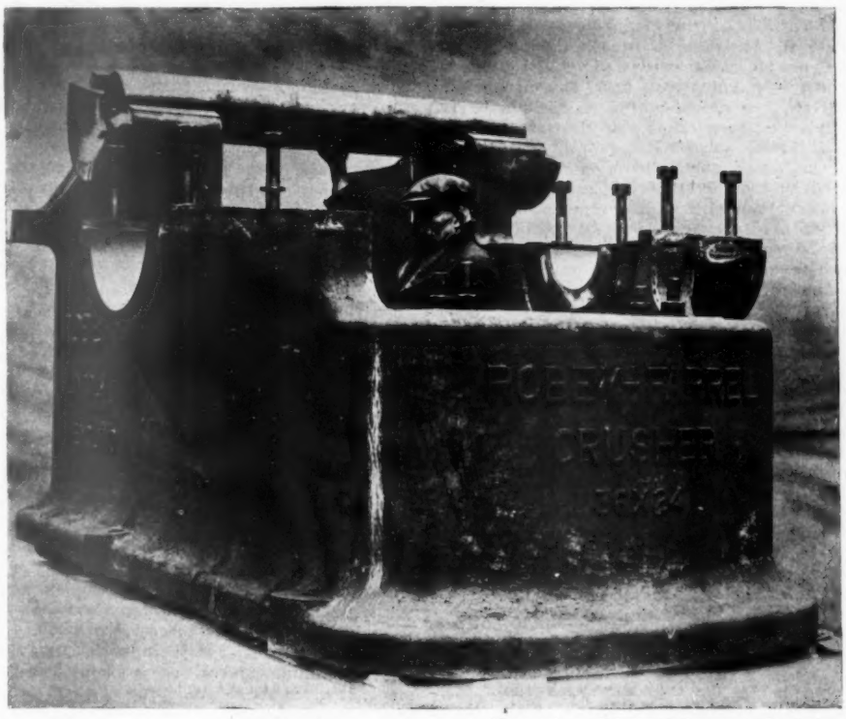
Ni-Tensyl also has a remarkable resistance to impact. Table I shows some actual results obtained on test bars machined from bars cast $\frac{1}{2}$ in. dia. The figures in each case are the average of two tests, the weight of blow being 0.481 ft.-lb. on notched bars 13 mm. dia. The very high figures obtained from cast Ni-Tensyl and from the same material after heat-treatment will be noted.

### Applications of Ni-Tensyl

Ni-Tensyl is being successfully used for machinery castings of all types—in many cases as a substitute for cast steel. In the production of Diesel engine flywheels, for example, it

* Extracted from a communication from the Research and Development Department of the Mond Nickel Company.

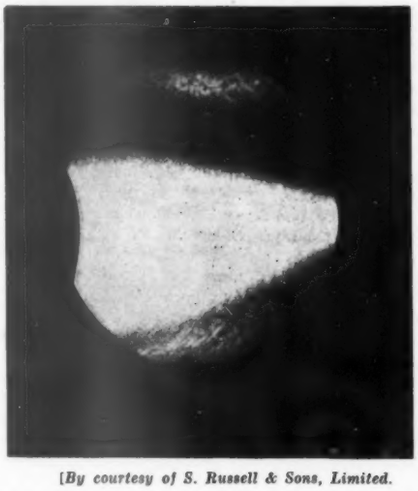
has been usual to employ cast iron only when the loading is light and the stresses are consequently not severe. When high loading is involved, it has been the practice to use flywheels of cast steel. Ni-Tensyl, however, may be safely used in place of cast steel and has the advantage over that material of being more economical in cost.



*[By courtesy of Robey & Company, Limited.*

FIG. 3.—LARGE CRUSHER FRAME IN NI-TENSYL.

Another example of the replacement of cast steel by Ni-Tensyl is illustrated in Fig. 2, which shows sugar-mill housings, cast under ordinary conditions and having a strength of about 22 tons per sq. in.



*[By courtesy of S. Russell & Sons, Limited.*

FIG. 5.—SHOWS INNER SURFACE OF BORE OF LARGE COUPLING CASTING IN NI-TENSYL.

A specially interesting instance of the successful use of Ni-Tensyl was in some very heavy frames which a foundry was called upon to produce. This report reads as follows:—

These frames presented particular difficulties because of their wide variation in section, flanges 1½ in. thick being joined to bosses and masses of metal of about 9 in. in thickness and of a relatively wide area. The frame castings were of four different types, and varied in weight from 12 cwts. to 38 cwts. each. The total weight involved was 132 tons. A minimum tensile strength of 18 tons per sq. in. on the 1.2 in. dia. bar was specified, while the castings had to be easily machinable, to be free from any surface blemish after machining all over and had to take on a high finishing polish. It was also specified that the castings were to be free from any open metal or porosity in the large holes bored from the solid in the heavy sections.

After preliminary experiments it was decided to adopt a Ni-Tensyl iron of the following approximate analysis:—T.C, 2.9; Si, 1.8; Mn, 0.5; P, 0.3; S, 0.1 and Nickel, 1.5 per cent. The base iron was made in two steps, the initial charge consisting of 75 per cent. of steel scrap. Inoculation was conducted with nickel and with about 1 per cent. of silicon.

An outstanding feature of these castings was the very high degree of uniformity secured, not only in individual castings, but over the whole series. The latter point is emphasised by the following figures representing the results of consecutive strength tests made upon material from the day to day run of Ni-Tensyl used in the production of these castings:

20.13—20.45—22.55—20.25—21.03—20.4—
20.32—20.94—19.99—21.41—21.77.

The average of these figures is approximately 21 tons per sq. in. The complete 132 tons of castings were successfully delivered, and after machining, the castings were found to be uniform throughout and to fulfil completely the conditions specified.

It should be pointed out that, in view of the extremely complex nature of the castings, it was decided to use a "mild" grade of Ni-Tensyl, the silicon being somewhat higher than is usually employed for maximum strength. Strengths up to 23 or 24 tons per sq. in. could easily have been secured if the silicon had been brought down to about 1.5 per cent., but this course would have increased casting difficulties.

Fig. 3 illustrates the use of Ni-Tensyl for crusher frames. This casting required 20 tons of metal and weighed 17 tons when finished, and yet, right in the centre of the 9 in. section, it had a strength of 23 tons per sq. in. In spite of a hardness of 250 Brinell the test bars and the castings machined perfectly.

*[By courtesy of S. Russell & Sons, Limited.*

FIG. 4.—CAM AND PULLEY-WHEEL IN NI-TENSYL.

Another important high strength application of Ni-Tensyl is in dies of different types for pressing or blanking sheet steel. An iron containing 2.7 to 2.9 per cent. carbon, and from 1.25 to 1.75 per cent. of both nickel and silicon, for instance, has been found particularly suitable, in the as-cast condition, for large and complicated dies, as well as for the smaller dies used for drop forging. In this condition it has a typical hardness of 230 Brinell and a strength of 25 tons per sq. in. For smaller dies the same iron, with the nickel content increased to 2.5 or 3.5 per cent., may be heat-treated, by oil-quenching from 850 deg. C. and tempering at

*[By courtesy of S. Russell & Sons, Limited.*

FIG. 6.—FACE PLATE CASTING OF NI-TENSYL.

(*Concluded on page* 106.)

# Shipbuilding and Engineering Evolution

## PRESIDENTIAL ADDRESS TO THE SOUTH WALES INSTITUTE OF ENGINEERS

Prof. Frederic Bacon, M.A., M.I.Mech.E., University College, Swansea, was installed as President of the South Wales Institute of Engineers at Cardiff last Thursday in succession to Mr. F. Llewellin Jacob.

PROF. BACON chose as the subject of his presidential address "Incidents in a Century of Ships, leading up to some remarks on the Principles of Engineering Evolution." He said that, naturally, the two recent incidents in a century of ships, which so vitally concerned the engineering profession, were the introduction of oil-fuel firing and the rise of the motor ship. But these incidents were too controversial for a presidential address; so he would limit himself to saying that the change over from canvas sails to coal-fired boilers was the biggest incident of all in the nineteenth century of ships; while the partial change over from coal to oil, so painfully felt in recent years, had probably done more than anything else to slow down industrial recovery since the war. But signs were not wanting that the blow had largely spent its force. Steam-driven machinery was putting up a far stiffer fight against the compression-ignition engine than a few years ago. Reciprocating engines and exhaust-steam turbines were cleverly and successfully uniting their forces on a single screw to keep the "tramp" from "taking to oil." Mechanical stokers were now doing well on board ship, and they had not yet heard the last of other methods of firing with solid, pulverised or colloidal fuel.

As for warships and fast liners, which were unrepentant burners of oil, they could say that the hydrogenation of coal on a big scale was no longer a dream, and the exhaustion of the oil wells of the world was going on apace. Surely, the prospects were that within the next 20 or 30 years—quite likely even sooner—all ships would turn back to the coalfields again as the ultimate source of their motive power.

Reviewing the century's advances in ship construction, the speaker recalled the decision of the directors of the Great Western Railway Company to instruct Brunel to design the steamboat "Great Western" at the time when he was already engaged in the construction of the Clifton suspension bridge. The "Great Western," a wooden sailing ship 236 ft. in length, with a displacement of 2,300 tons, fitted with auxiliary steam power in the form of side-lever engines driving paddle wheels, left Bristol on her maiden voyage on April 8, 1838, and arrived at New York in 13½ days, with a reserve of 200 tons of coal still in her bunkers. Paddle wheels were succeeded by screw propellers and F. P. Smith built the "Archimedes" of 200 tons, which circumnavigated Great Britain, and screw propulsion came into its own. Having recorded the success in this direction of Stockton, Ericsson, and others, the speaker went on to relate how Brunel came to design the pioneer ship "Great Britain," which was half as big again as the "Great Western" and built of iron. She left Liverpool on August 26, 1845, and arrived at New York in 14 days and 21 hrs. She stranded in 1846 off the coast of Ireland and was abandoned. Ten months later, after withstanding the battering of heavy seas, she was salved and traded for nearly 40 years as a steamer, having convinced the most sceptical of the suitability of iron for shipbuilding. It was a spectacular demonstration of the toughness of the iron ship.

### The "Great Eastern"

In 1851 Brunel, continued Professor Bacon, began to study the problem of constructing a vessel capable of carrying coal sufficient for a voyage to Australia and back, at an average speed of 14 knots, and designed the "Great Eastern"—a giant ship born out of due time—693 ft. long overall; breadth of hull, 83 ft.; over paddle boxes, 120 ft.; displacement at 32 ft. draft, 30,000 tons. How much the "Great Eastern" was born out of due time can be judged by the fact that the first ship to reach, and even then only slightly exceed, her length was the White Star liner "Oceanic," built 41 years later. The "Great Eastern," with screw propeller and paddle wheels, was launched in January, 1858, and was sold uncompleted, in the same year, for little more than the launching had cost. Her completion became a point of national honour, and, finished at last, she left her moorings on September 7, 1859, to steam round the South Coast; but illness had compelled Brunel to take leave of her two days earlier, and by the time the ship was off Weymouth Brunel was dead, worn-out by his incessant labours and heavy anxieties, at the early age of 53 years. The speaker gave the story of the "Great Eastern's" chequered career, ending with the laying of the second Trans-Atlantic cable in 1866. For several years she was used in the Mersey as a floating signboard for a large retail store and was broken up in 1888.

### The "Turbinia"

In 1897, Queen Victoria's diamond jubilee year, Parsons made history with the "Turbinia," which attained 34 knots at the Naval Review off Spithead, by the application of the turbine to the propulsion of ships. In 1900 a single tiny ship of 2,000 h.p. was the sum total of marine turbine power. In 1935 Walker estimated that the world total of marine turbines had mounted to about 50 million h.p. At the end of August last the "Queen Mary," over 1,000 ft. long and displacing 110,000 tons, driven by turbines of 200,000 h.p. crossed from the Ambrose Light to the Bishop Rock in 3 min. short of four days, so putting up an average speed across the Atlantic of 30.63 knots against the "Normandie's" best of 30.31. Was it really only engineers that could grasp that what Parsons did in 1897 and afterwards, was far more permanently momentous to the world than anything Gladstone said in 1870 or at any other time?

### The Professional Engineer

Continuing, the speaker said that, to a large extent, the professional engineer had to take his orders from individuals and groups of men who were not engineers. If such people were better informed as to what conformed and what ran counter to established principles of engineering evolution, the lot of the engineer, who at present had to struggle against their ignorance of such matters, would be lightened. To get an inkling of some of the advantages which might accrue, the speaker asked his hearers first to consider what had happened in consequence of the recognition and wide dissemination of the principle of the conservation of energy. It stood to the credit of the educational machine that, in spite of the extreme youth of this principle as compared with the propositions of Euclid or even Newton's laws of motion (for it only matured in a few master minds like Kelvin's about 85 years ago), it had now been widely taught in schools for several decades. True, the perpetual-motionist had not yet been exterminated; but most people knew enough to suspect him of being a quack. The number of people who had been taught to recognise and respect the principle of the conservation of energy was sufficient seriously to spoil his prospects of securing funds from the credulous and ill-informed, so undoubtedly preventing a great deal of money being thrown away, year by year, on worthless schemes which involved its violation. The speaker's proposal would be that a principle of engineering which should be well drummed into the rising generation was that "innovations necessitate risking large sums of money." Backed only to the extent of £100, no important invention ever did, nor ever could, get anywhere. By risking £10,000, something could sometimes be done; but as in the case of Parsons, for instance, it was often necessary to risk the entire loss of £100,000 or more; and in certain cases, *e.g.*, the hydrogenation of coal, many millions of pounds sterling might have to be risked.

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## Production and Properties of Ni-Tensyl

(*Concluded from page* 105.)

350 deg. C., to give a hardness of 400 Brinell and a tensile strength of 30 tons per sq. in. Practical experience has shown that for these small dies this material can successfully replace more costly steels, where production requirements do not justify the expense of using the latter.

The use of high-duty cast irons for dies has the further advantage that it simplifies die construction. Instead of using a complex design, involving many parts in different metals, it is possible in many cases to cast the whole die in one piece from Ni-Tensyl in such a way that after machining, and with or without heat-treatment, it gives the desired properties of strength and wear-resistance.

Ni-Tensyl has been found in practice to possess an excellent resistance to wear. Some Ni-Tensyl scraper blades in a foundry sand mill, for instance, showed conclusively that this material, whether as cast or heat-treated, has very many times the life of a plain cast iron.

Other applications dependent on the strength and wearing quality of Ni-Tensyl are cams and pulley-wheels, typical examples of which are shown in Fig. 4. It has been pointed out that although the use of Ni-Tensyl for these castings is justified by its strength, even more impressive is the uniformity of the metal in varying sections. In Fig. 5, a typical example of the internal bore of a large boss, in which one would expect to find open metal, the Ni-Tensyl casting is seen to be perfectly dense all over the surface.

Other applications of Ni-Tensyl occur in the power field, where it has been used for turbine casings, frames of Diesel engines, large gearboxes, valve bodies and similar castings. It has also been used for Diesel heads and in preliminary tests has proved satisfactory for Diesel engine liners. In many of these applications a special feature is the fact that the high strength of Ni-Tensyl permits a reduction of scantlings, of particular importance when such castings are required for marine construction. In this field there is therefore scope for the use of Ni-Tensyl, not only for turbine casings and Diesel castings, but also for general structural castings such as foundation plates, bedplates and condenser bodies.

### Conclusion

In Ni-Tensyl engineers are offered a new type of alloy cast iron of specially high strength and wearing quality. It permits a very considerable increase in stresses or decrease in weights, according to requirements. Ni-Tensyl is adaptable to castings of all types and in many cases it successfully replaces more costly materials, such as steel.

# Leaded Gunmetals Discussed in London

A few more interesting points were brought out when the Report from the Sub-Committee of the Technical Committee of the Institute of British Foundrymen on Specifications for Two-Leaded Gunmetals was discussed by members of the London Branch of the Institute at a meeting over which Mr. Delport presided.

MR. G. L. BAILEY, M.Sc., presenting the report on gunmetals, which was prepared by the Non-Ferrous Metals Sub-Committee, made it clear that the object of the Sub-Committee was to provide users with a number of accepted specifications which would permit a reduction in the large number now worked to. There was only one official British Specification in existence for cast gunmetals, he said, and that was for the 88:10:2 alloy, yet a very large number of other gunmetals were used. Individual users necessarily had to put forward their own specifications, and the foundryman was asked to provide a wide variety of alloys differing in some minor respects. The Sub-Committee felt that if some leaded gunmetals typical of the most important types used could be standardised, users would be glad to adopt them. The report contained the recommendations of the Sub-Committee with regard to two leaded gunmetals which it was thought could with advantage be standardised and would cover a wide variety of different users' specifications.

## DISCUSSION

MR. V. DELPORT (Branch-President) emphasised the importance of the work of the Sub-Committees of the Institute's Technical Committee, and pointed out as an illustration that the Non-Ferrous Metals Sub-Committee Report showed that they were endeavouring to effect a reduction of the number of gunmetals from 37 to 2, which was important from the point of view of simplification as well as from other viewpoints. With regard to the report on the dimensional tolerances for castings,* he said that the endeavour to remove lax wording and to substitute unambiguous phraseology in specifications was in itself of the utmost value, quite apart from other aspects of the matter dealt with in the report. He was anxious that there should be a real appreciation of the value of the work that was done by the various Committees on behalf of all members of the Institute.

### Compositional Tolerances

MR. H. E. HAND pointed out that the report on gunmetals made no reference to tolerances or impurities.

MR. BAILEY suggested that the problem of tolerances was provided for by the method of setting out the compositions. The report stated the minimum contents of tin and the maximum contents of lead in the alloys; the foundryman was relied upon to apply his economic sense and not to exceed the minimum content of tin by more than was necessary or to use very much less lead than the quantities stated.

Admittedly, the Sub-Committee had not dealt fully with the problem of the effects of impurities and the specification of tolerances on impurities. The Sub-Committee's view with regard to impurities in the commoner grades of gunmetal was that the only impurities likely to be troublesome were those which would give inferior results in other respects, and the Sub-Committee was not at the moment inclined to recommend specific limits on impurities.

MR. J. KING, who was rather impressed by the design of the test bar recommended in the gunmetals report, asked whether any experiments were made with any other type of test bar or whether the Sub-Committee was sure that that particular design would give the best results.

MR. BAILEY replied that the Sub-Committee's experiments on the test bar were conducted some considerable time before he had become a member, and he had not the figures relating to the experiments whereby the recommended design of test bar had been arrived at. However, he understood that tests were made on a number of different types of test bar, in the works of various members of the Sub-Committee, before the recommended design was produced, not as the type of bar which necessarily gave the best results with any one alloy, but as the type which gave the most uniform results as between the productions of one foundry and another.

### Auto-Annealing

MR. KING asked whether any data were collected concerning the length of time the bars were left in the moulds after pouring, because the problem of self-annealing had to be considered.

MR. BAILEY replied that the Sub-Committee had obtained no information on that matter. Self-annealing was a common term in connection with aluminium bronze castings, with which material it was of importance, but he doubted that, in a comparatively small bar such as that recommended in the gunmetals report, the rate of cooling would be sufficiently slow or capable of wide enough variation to affect the properties of the material markedly. A cast-on bar might cool very slowly, due to the slow cooling of the main casting, and in that case the slow cooling had a considerable effect on the test results, but the Report deals only with separately cast bars.

MR. KING said that in his experience the rate of cooling had a certain effect, especially on very thin castings and where the section of the bar was distinctly greater than the section of the casting. In that case the casting cooled much more quickly than the bar, and variable results were obtained in tests with identical compositions of metal. He had in mind particularly the ordinary B2 Admiralty gunmetal of 88:10:2 composition; but in a gunmetal containing 5 per cent. of lead (he had used the 85:5:5:5 composition) he did not think that self-annealing had any marked effect. He commented that the range between the two specifications was very small.

### Details of Running Missing

MR. H. O. SLATER (Past Branch-President) suggested that the illustration of the design of test bar recommended in the gunmetals report was rather misleading, for it did not show how the test bar was run. To a foundryman the problem was quite simple; but an engineer—and a good many engineers were dominating foundries to-day, rightly or wrongly—might dictate as to the method of casting the test bar. In the illustration the ingate was double the size of the bar. An inexperienced person who tried to make a test bar of the kind illustrated might get a great deal of air and dirt into it; therefore, Mr. Slater suggested that the illustration should include a runner which would exclude both air and dirt at the same time.

Complimenting the members of the Non-ferrous Metals Sub-Committee on the spirit in which they had carried out their work in regard to the leaded gunmetals, Mr. Slater emphasised how greatly a specification could be influenced by some whim or fancy of a very young metallurgist or a very old engineer who might have some pet themes on composition. Therefore, he urged, the publication of definite specifications for certain test bars was very useful indeed.

MR. BAILEY said, with regard to the actual design and the method of running the test bars, the Sub-Committee had not given the co-operating foundries any more information than was given in the report. But it was assumed that the bars would be made by foundrymen.

### Cast-on or Separately-Cast

MR. KING said that as a foundryman he had been impressed at once by the fact that the test bar illustrated in the Report was not an integral part of the casting, whereas in specifications dealing with Admiralty gunmetal, and so forth, the test bars must be integral parts of the castings.

MR. BAILEY replied that the Sub-Committee did not recommend the cast-on bar, and all the data given in the Report were based on the use of separately-cast bars. He believed there were still some purchasers who insisted upon the cast-on bar, but the Sub-Committee felt they could make no provision for such purchasers. The time would come, he believed, when the purchaser would realise that the cast-on bar was not to his own advantage. The separately cast bar gave a better indication of the quality of the metal, and the foundryman was afforded a better chance of producing a good casting than he would have if he had to bother about running the metal in order to get the best properties in the cast-on test bar rather than in the casting. Mr. Bailey personally considered it very undesirable to cast the test bar integral with the casting.

### Manufacturing Details of Leaded Gunmetals

MR. H. W. CARTER asked how much phosphorus or a deoxidiser was used in the casting of the two leaded gunmetals referred to in the Report of the Non-Ferrous Metals Sub-Committee.

MR. BAILEY replied that to the best of his knowledge no phosphorus or deoxidiser was added.

MR. CARTER asked if anything were added to reduce the porosity of the castings.

MR. BAILEY replied in the negative.

MR. CARTER asked if it were intended that the two leaded gunmetals dealt with in the Report should displace leaded bronzes for bearings.

MR. BAILEY said that the Sub-Committee had done a considerable amount of work on leaded phosphor bronzes, but that work had not yet reached the stage which would enable the Sub-Committee to make recommendations for specifications. It was the intention to make such recommendations, however, when sufficient data had been obtained.

MR. CARTER asked if the Sub-Committee had figures available on the coefficients of friction and material flexure of the bronzes.

MR. BAILEY replied that it had not. The bronzes were used to some extent for bearings, but they were also used very largely for ordinary hydraulic casting work, into which factors such as coefficients of friction, did not enter.

MR. CARTER asked what deoxidiser was likely to be required in casting the bronzes or leaded bronzes.

MR. BAILEY said he would not care to suggest that phosphorus in small amounts should never be added to the gunmetals dealt with in the Report. It should be added only when the metal was suffering from excessive oxidation, and even then it should be used in extremely small amounts. The Sub-Committee had worked only with good quality clean metal and had assumed that such metal—it might be re-melted scrap and not necessarily virgin metal—would be used in manufacture, and also that the founders would adopt the correct melting procedure in order to avoid contamination.

MR. R. PIPES recalled that some time ago he had received from a very well-known engineering firm a specification relating to leaded gunmetals or bronzes, in which specification it was stated that the impurities in the metal should be nil. Therefore, he said, work such as the Non-Ferrous Metals Sub-Committee were doing with regard to standardisation of specifications was essential.

### Vote of Thanks

MR. H. O. SLATER proposed a vote of thanks to Mr. Bailey for his presentation of the report. The vote of thanks was seconded by Mr. H. E. Hand and carried with enthusiasm. Mr. Bailey briefly responded.

* Discussion on this to be published next week.

# The Week's News in Brief

## Trade Talk

R. B. TENNENT, LIMITED, are making extensions to their Whifflet Foundry, Coatbridge, for the production of Adamite rolls.

THE TELEPHONE NUMBER of the British Bath Company, Limited, of Greenford, Middlesex, has been changed to Waxlow 2266 (3 lines).

JOHN HASTIE & COMPANY, LIMITED, are to erect a new building in Nicholson Street, Greenock, and are also to extend their Caledonian Foundry.

EXTENSIONS ARE TO BE MADE to the British Aluminium Company's factory at Fort William. The work will include the laying of further pipe lines.

LEY'S MALLEABLE CASTINGS COMPANY, LIMITED, held their annual ball in Derby recently. Mr. F. D. Ley, general manager, was amongst the 200 people who attended.

ABOUT 15,000 TONS OF IRON, 80 per cent. of which is cast iron, are amongst the *débris* of the Crystal Palace. Tenders for the clearing of the site are now ready and will be advertised shortly.

BUCKHAVEN AND LEVEN GAS COMMISSIONERS have accepted the offer of H. Balfour & Company, Limited, Durie Foundry, Leven, for a new purifying plant to be erected at the Leven Gasworks.

THE NORTH-EASTERN MARINE ENGINEERING COMPANY, LIMITED, Wallsend, have received contracts for the installation of superheaters in the vessels "Caledonian Monarch" and "British Monarch."

INTERNATIONAL COMBUSTION, LIMITED, of Derby, have secured an order for boiler plant for a new steel works in Turkey, and one for additional boilers for the South African Electricity Commission.

THE MARSMAN GROUP of mining companies have built and equipped a modern hospital at Paracale, in the Philippine Islands, for the benefit of their staff. The companies experienced excellent trading conditions during last year.

THE OFFICES and drawing office at the Blantyre Engineering Works and Foundry, Hamilton, of the Blantyre Engineering Company, Limited, were damaged by fire last Saturday. Arrangements have been made to carry on business as usual.

THE PRESENT EXTENSIONS being carried out at the Loughborough works of Herbert Morris, Limited, are nearing completion, but more extensions are to be made, so that eventually the North and South works will have about 23 acres under cover.

RANKIN & BLACKMORE, LIMITED, Eagle Foundry, Greenock, are to construct the propelling machinery, consisting of triple expansion steam engines, for a cargo steamer to be built by Burntisland Shipbuilding Company, Limited, for Brown, Atkinson & Company, Limited, Hull.

A NEW FOUNDRY and machine shop has been opened at Irthlingborough Ironworks, Wellingborough, of the United Steel Companies (Thomas Butlin & Company Branch). It is understood that the new works will manufacture material in connection with the extensions to the London underground railway system.

EVERY EMPLOYEE at the bell foundry of John Taylor & Company, Loughborough, received a gift from Mr. Moore, of Kansas, who sent a cheque for £50 to the firm, with a request that the money should be divided between the workmen. This gift was in recognition of a carillion built by John Taylor & Company for an American university.

THE REGISTERED OFFICE of General Refractories, Limited, will, at the end of this month, be removed to Russell House, Adam Street, Strand, London, W.C.2, and the registration department and the share transfer office will, as from February 1, be at that address. The Committee of the London Stock Exchange has accepted the company's application for markings of the dealings in its shares to appear henceforth in the Official List.

THE SCOTTISH DISTRICT COUNCIL of the National Union of Foundry Workers, at a conference in Glasgow, last Saturday, decided to ask the General Council to prepare a demand to the employers for a 10s. increase in wages. It was decided to restrict overtime to the minimum. The Council also conferred T.U.C. diplomas and silver badges on J. Grant and H. Baynham, of Kirkintilloch; A. Paul, Denny; G. Drummond, Dumbarton; and A. Mitchell and R. Hart, Glasgow. These members have each enrolled more than fifty members. The total membership for the United Kingdom is now 25,912, and 3,000 members were enrolled in 1936.

AT A MEETING held on December 22, 1936, the Founders' Section of the Polish Technical Association was liquidated. At the same meeting the Technical Association of Polish Founders (Stowrazyszenie Techniszne Odlewnikow Polskich) was formed, and will represent Poland as a member of the International Committee of Foundry Technical Associations. The President of this new organisation, which has its headquarters at Warsaw, Politechnika, Zakiad Odlewnictwa, ul. Polna 3, is Prof. K. Gierdziejewski, and the general secretary is Mr. Z. Lenartowicz.

THE FOLLOWING FIRMS engaged in the foundry and allied industries made contributions to charity during last year:—Shaw Glasgow, Limited, £264; Springfield Steel Company, Limited, £102; Lion Foundry Company, Limited, £113; Cruickshank & Company, Limited, £227; James Howden & Company, Limited, £475; Babcock & Wilcox, Limited, £252; Drysdale & Company, Limited, £345; Blair's, Limited, £226; Blantyre Engineering Company, Limited, £71; Singer Manufacturing Company, Limited, £1,885; James Dougall & Sons, Limited, £154; Lancefield Foundry Company, Limited, £50; Jones & Campbell, Limited, £444; Coltness Iron Company, Limited, £4,806; Scottish Iron & Steel Company, Limited, £402; A. F. Craig & Company, Limited, £136; D. & J. Tullis, Limited, £251; William Simons & Company, Limited, £223; Mirlees Watson Company, Limited, £529; Qualcast, Limited, £525; International Combustion, Limited, £350; Dobbie Forbes & Company, Limited, £180; the Glasgow works of Harland & Wolff, Limited, £1,319; Mitchell, Russell & Company, Limited, £299; Wilson Bros. (Pipe Fittings), Limited, £59; Lane & Girvan, Limited, £175; and Smith & Wellstood, Limited, £762.

## Contracts Open

**Finningley,** January 30.—3,400 yds. of 8-in. and 6-in. cast-iron water mains, for the Doncaster and Tickhill Joint Water Board. D. Balfour & Sons, consulting engineers, 3, St. Nicholas Buildings, Newcastle-upon-Tyne. (Fee £3, returnable.)

**Hull,** February 5.—Steel tyres for tramcars, castings (malleable and iron), castings (non-ferrous), steel and steel sheets, for the Transport Department. Mr. J. Lawson, general manager, Transport Offices, Ferensway, Hull.

**Macclesfield,** February 10.—Iron castings, for the Town Council. Mr. R. Clegg, town clerk, Town Hall.

**Rishton,** February 1.—Iron castings, for the Urban District Council. The Surveyor, Council Offices.

**Watford,** February 15.—Cast-iron pipes, for the Town Council. Mr. W. W. Newman, borough engineer, Municipal Offices.

**York,** February 8.—Iron and steel, for the Town Council. Mr. C. J. Minter, city engineer, Guildhall.

## New Companies

*(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)*

**Butler Machine Tool Company, Limited,** Victoria Ironworks, Halifax.—Capital, £350,000. Directors: H. Butler, J. W. Butler, and G. M. Butler.

**Anti-Friction Bearing Company, Limited,** 49, Harford Street, Birmingham.—Capital, £5,000. Directors: Rose M. Gilbert, F. S. Gilbert, and W. H. Wood.

**Wayhold Products, Limited,** Precision Works, Helena Street, Smethwick.—Capital, £2,000. Engineers, machine-tool makers, etc. Directors: H. W. Wagstaff, J. M. Holling, and G. Bach.

**Heenan, Beddow & Sturmey, Limited,** Newton Heath Ironworks, Manchester.—Capital, £100,000. To acquire the undertakings of Heenan Construction Company, Limited, and Beddow & Sturmey, Limited, and the business of C. H. Pinson, and to carry on the business of steel makers and converters, metal founders, tool makers, etc. Directors: H. Lane and C. O. Lane.

## Personal

MR. W. A. WARD has joined the board of directors of Bennis Combustion, Limited, and will act as general manager.

MR. ARNOLD CARR, of Thos. W. Ward, Limited, Sheffield, has changed his private address to 122, Furniss Avenue, Dore, near Sheffield.

MR. WILLIAM HAMILTON TELFER, J.P., vice-chairman of the Coltness Iron Company, Limited, has been appointed a deputy lieutenant of the County of Lanark.

MR. ALEXANDER PATERSON SCOTT, who has been employed by James F. Low & Company, Limited, founders, of Monifieth, has been appointed assistant engineer with the Malayan Tin Dredging, Limited, at Perak, Malay States.

MR. S. J. PIGGOTT, managing director of John Brown & Company, Limited, Clydebank, who designed and supervised the installation of the engines for the "Queen Mary," will be elected President of the Institute of Marine Engineers in March.

DR. R. S. HUTTON, Professor of Metallurgy at Cambridge, is to present the annual lecture to the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers at a meeting to be held during February in New York.

## Obituary

MR. ALEXANDER DUNN, a retired patternmaker, who had been employed by Glenfield & Kennedy, Limited, Kilmarnock, died last week, aged 71.

THE DEATH HAS OCCURRED, at the age of 83, of Mr. W. Ross Lane, chairman of Lane & Girvan, Limited, Caledonia Stove Works, Bonnybridge.

MR. ARTHUR WORMALD, O.B.E., until a few months ago a director and general works manager of Rolls-Royce, Limited, died recently, aged 63.

MR. WILLIAM FINLAY, who died on January 19, was, until his retirement 10 years ago, appointed foreman in Cammell Laird & Company, Limited's, works at Sheffield.

THE DEATH HAS OCCURRED of Mr. Francis Bell, a pioneer of the engineering and foundry industry of the Rand. He was the proprietor of the Britannia Engineering Works and was eighty years old at the time of his death.

THE DEATH OCCURRED on January 15 of Mr. Robert Arthur Cullen, a retired foreman patternmaker. Mr. Cullen, who was 83 years of age, retired about 10 years ago, and had previously been employed by the Burnbank Foundry Company, Limited, Falkirk.

MR. THOMAS MARTIN YEADEN, managing director of John Lynn & Company, Limited, ironfounders, of Sunderland, has died. Mr. Yeaden, who had been connected with the firm since 1897, was a member of the standing committee of the North-East Coast Engineering Employers' Association.

## Forthcoming Events

**Institute of British Foundrymen**

FEBRUARY 1.

*Falkirk Section*:—Joint meeting with The Institute of Vitreous Enamellers. "Sands and Facings with reference to Light Castings for Enamelling." Paper by H. McNair, at the Temperance Café, Lint Riggs, Falkirk, at 7.15 p.m.

FEBRUARY 3.

*London Branch*:—"Steel Castings," Paper by J. Deschamps, at the Charing Cross Hotel, London, W.C.2, at 8 p.m.

FEBRUARY 4.

*East Anglian Section*:—"Some Considerations of Cupola Operation." Paper by H. H. Shepherd, at the Lecture Hall, Central Library, Ipswich, at 7.30 p.m.

*Sheffield Branch*:—"The Heat-Treatment of Castings." Paper by Dr. R. Hunter, at the King's Head Hotel, Change Alley, Sheffield, at 7.30 p.m.

FEBRUARY 5.

*Birmingham Branch*:—"High-Duty Alloy Cast Iron." Paper by Dr. A. B. Everest, Ph.D., at the James Watt Memorial Institute, York House, Great Charles Street, Birmingham, at 7.30 p.m.

FEBRUARY 6.

*Lancashire Branch*:—Annual Dinner at the Grand Hotel, Manchester.

**The Institute of Vitreous Enamellers**

FEBRUARY 4.

*Northern Section*:—"Heat Resisting Muffle Equipment." Paper by A. L. Fawkes, at the Queen's Hotel, Manchester, at 7.30 p.m.

# WM. CUMMING
## AND COMPANY LIMITED

IRONFOUNDERS' FACINGS MANUFACTURERS AND GENERAL FOUNDRY FURNISHERS

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***The Leading Manufacturers...***
***The Oldest Established...***
***The Most Reliable...***

**COAL DUST**
Superlatively Regular in Grist. Superior in Quality. Seven Grists Standardised.

**FOUNDRY BLACKINGS**
For all Purposes. The Best on the Market. Manufactured by the New Process.

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**BRITISH PLUMBAGOS**
At Low Prices. Imported Direct. No Continental Adulteration.

**POWDERED CORE GUM**
British Manufacture. Best Quality.

**CUMMING FURNACE**
Users of the New "Cumming" Furnace are Increasing Week by Week.

CUMMING'S CRIC RELIABLE IRON CEMENT

**THE CUMMING HAND RAM MOULDING MACHINE**
**CORE COMPOUNDS • PARTINGS**
**CUMMINGSTONE • REQUISITES**

***All our own manufacture***

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**Kelvinvale Mills, Maryhill,**
**GLASGOW**

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**FALKIRK • CHESTERFIELD . DEEPFIELDS AND MIDDLESBROUGH**

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# Raw Material Markets

Iron and steel working-up plants are all actively engaged, and indications are that similar conditions will prevail over a long period. The extensive rearmament programme now being carried out by the Government is adding considerably to the pressure for deliveries of supplies under existing contracts. Material available on the open market is almost negligible. A new furnace of the most modern type was lighted by the Skinningrove Iron Company, Limited, on Saturday. When in full commission, the new furnace will be capable of producing 1,200 to 1,800 tons of iron a week.

## Pig-Iron

**MIDDLESBROUGH.**—Consumers continue to find it difficult to place new business, and even to secure delivery of contract material. Prospects are not exactly happy, as it is sure to be a very considerable time before there is any marked increase in the available tonnage. No. 3 Cleveland G.M.B. is quoted at 81s. per ton in the Middlesbrough area, 83s. elsewhere on the North-East Coast, 84s. in Falkirk, and 87s. in Glasgow, with No. 1 foundry at a premium of 2s. 6d. A similar stringency as regards supplies is also apparent in the hematite market. The minimum quotations for East Coast mixed numbers are 97s. 6d. per ton on the North-East Coast, 103s. in Sheffield, and 108s. 6d. in Birmingham. For special-quality hematite, premiums up to 16s. 6d. per ton are now being charged.

**LANCASHIRE.**—While a few replacement contracts have been made during the past week new business has not involved any substantial tonnage. Heavy deliveries have, however, been made. For delivery to users in the Lancashire price zone, offers of Staffordshire and Derbyshire brands of No. 3 foundry iron are on the basis of 89s. per ton, with Northamptonshire at 87s. 6d. West Coast hematite is quoted at 106s., with East Coast material at 105s. 6d., delivered equal to Manchester and subject to a rebate of 5s. per ton. Supplies are scarce. Scottish foundry iron at around 105s. per ton receives a steady inquiry.

**MIDLANDS.**—While makers are despatching deliveries as well as they can, consumers' needs are by no means being fully met. Especially is this the case in respect of Northamptonshire iron. The controlled quotations for delivery to Birmingham and Black Country stations are 83s. 6d. for Northamptonshire No. 3 and 86s. for Derbyshire and Lincolnshire No. 3 An extra of 11d. per ton is charged for delivery into users' works. A small sliding-scale rebate is allowed to large consumers. The prices of refined iron vary considerably, according to quality, but makers have agreed that the minimum shall be £6 17s. 6d. per ton. Medium-phosphorus iron is quoted at 90s. to 95s., with low-phosphorus at 97s. 6d. to 107s. 6d., delivered the Midlands. There is a good inquiry, but supplies are fairly plentiful. The controlled prices of hematite are £5 9s. 6d. for West Coast mixed numbers, £5 8s. 6d. for East Coast No. 3, and £5 8s. for Welsh mixed numbers, with 1s. 6d. extra if delivered into works. Arrears in deliveries are considerable and the outlook is not encouraging.

**SCOTLAND.**—Prices of pig-iron remain at 90s. 6d. for No. 1 foundry and 88s. for No. 3 foundry, f.o.t. furnaces. Deliveries are behind schedule, and makers are taking from two to three weeks to despatch even small tonnages. Cleveland iron is scarce, and this is proving very inconvenient to light-castings makers, who are well employed and who require heavy tonnages of material from this area. No. 3 foundry is quoted at 84s. f.o.t. Falkirk and 87s. f.o.t. Glasgow. Mixed numbers of hematite are quoted at 98s., less 5s. rebate, and basic, British and Indian, is 82s. 6d., less 5s. rebate, both delivered steelworks. Producers are unwilling to add to their commitments at the present time.

## Coke

The shortage of coke continues to be a source of concern both to producers and consumers. In some cases contracts entered into many months ago are in arrears, and consumers frequently have to be content with much smaller deliveries than they had ordered. Quotations are very firm. For delivery in Birmingham and district, best Durham coke is quoted at from 42s. 6d. to 45s., and Welsh from about 40s. to 54s. per ton.

## Steel

In most departments of the steel market the difficulty of placing orders for reasonably near delivery dates is limiting the volume of business, says the official report of the London Iron and Steel Exchange. In the semi-finished section demand is considerably in excess of supply, and anxiety is felt regarding the position which may develop later in the year. Disappointment has been caused by the delay in the arrival of Continental semis owing to the shortage of steel which now prevails in the principal manufacturing countries. Acute scarcity also rules in the finished steel market, notwithstanding the heavy tonnages which are being delivered by the makers to the consuming works. Although there is a heavy export inquiry, the quantities available have had to be severely restricted in order to meet so far as is possible the requirements of the home market.

## Scrap

The possibility of a shortage of iron and steel scrap is being increasingly canvassed. Owing to the expanding demand on the Continent, imports of steel scrap into this country are on a considerably reduced scale. The question of supplies, however, is by no means the only source of concern to producers. Prices are rising, and a continuance of the upward trend cannot fail to affect production costs. Efforts are being made to relieve the situation, and a suggestion for long-term contracts with the suppliers to ensure stability and to give security in the question of costs over a period has been put forward, while the setting up of a central buying organisation by the steelmakers has also been suggested.

All grades of scrap are well taken up in the Cleveland area, and prices have further increased. A revival of business has been noticeable in the South Wales market, and heavy tonnages are passing into consumption. As in the case of other districts, the supply position is causing some concern. Buyers in the Birmingham area have taken a more active interest recently, but only a small amount of business has been transacted in the Midlands as a whole. Differences of opinion with regard to prices have led to unusual quotations in Yorkshire, but it is considered to be only a question of time before consumers bring their offers into line with sellers' demands. There is a good inquiry in Lancashire, and stocks are rapidly being reduced. In Scotland the supply of scrap does not satisfy the demand, and users are not getting their full requirements.

## Metals

**Copper.**—Uncertain conditions have prevailed in this market and prices have fluctuated considerably. It is believed that French liquidation and further unsatisfactory news of the labour trouble in the United States have been primarily responsible. New business has been quiet.

Daily market prices :—

*Cash.*—Thursday, £52 10s. to £52 11s. 3d.; Friday, £52 5s. to £52 7s. 6d.; Monday, £51 6s. 3d. to £51 7s. 6d.; Tuesday, £51 17s. 6d. to £52; Wednesday, £52 8s. 9d. to £52 10s.

*Three Months.*—Thursday, £52 12s. 6d. to £52 13s. 9d.; Friday, £52 7s. 6d. to £52 10s.; Monday, £51 8s. 9d. to £51 10s.; Tuesday, £52 to £52 1s. 3d.; Wednesday, £52 10s. to £52 11s. 3d.

**Tin.**—In contrast to the fluctuations that have been noticeable in other non-ferrous metals, the tin market has remained steady. A moderate inquiry has been reported. As a result of the motor-industry strikes in the United States, consumption there has fallen considerably of late. The January issue of the International Tin Research and Development Council's bulletin, compiled by The Hague Statistical Office, estimates world consumption of tin for 1936 at 154,000 tons, against 142,500 tons in 1935.

Metal Exchange quotations were as follow :—

*Cash.*—Thursday, £230 10s. to £230 15s.; Friday, £230 to £230 5s.; Monday, £226 10s. to £226 15s.; Tuesday, £226 5s. to £226 10s.; Wednesday, £227 to £227 5s.

*Three Months.*—Thursday, £231 10s. to £231 15s.; Friday, £230 10s. to £230 15s.; Monday, £227 7s. 6d. to £227 12s. 6d.; Tuesday, £226 15s. to £227; Wednesday, £227 10s. to £227 15s.

**Spelter.**—The weekly report issued by Rudolf Wolff & Company states that "the unsettled conditions which have prevailed in this market are due to the uncertainty which has developed in the general situation, and which at times has precipitated some heavy selling and liquidation. At the lower levels, however, the market was well supported, a fairly active demand on the part of consumers developing at the same time. Consumption is reported to be well maintained, and there has been no pressure to sell on behalf of producing interests. On the Continent, a rather steadier market is reported, with a fairly good demand on the part of consumers, and sales on the London market from this quarter have not been heavy. In the United States, a quiet market is reported."

Official quotations were as follow :—

*Ordinary.*—Thursday, £22 7s. 6d.; Friday, £22; Monday, £21 10s.; Tuesday, £21 17s. 6d.; Wednesday, £21 16s. 3d.

**Lead.**—A recovery has been made in this market, and it is suggested that the recent review of the international situation by Mr. Anthony Eden has inspired confidence in the outlook.

Day-to-day quotations :—

*Soft Foreign (Prompt).*—Thursday, £27 18s. 9d.; Friday, £26 18s. 9d.; Monday, £26 12s. 6d.; Tuesday, £26 11s. 3d.; Wednesday, £27 5s.

## Non-Ferrous Metal Prices in 1936

The outstanding economic feature of 1936, state the British Metal Corporation in their annual review of the base metal markets, was the rise in prices of primary commodities in the last half of the year. Non-ferrous metals, it is pointed out, rose much more than the average for all primary commodities. The rapidity of the rise in metal prices, rather than the heights they have attained, is considered particularly noteworthy. "The improvement in commodity prices," states the review, "has been caused by expanding consumption and falling stocks. But the pace became faster after the devaluation of the franc at the end of September, and the currency agreement between France, the United Kingdom and the United States, to which Belgium, Holland and Switzerland later adhered. Forward buying grew in volume in the belief that improved monetary conditions must broaden revival. Speculators turned first to metals. Stocks were no longer large and high rates of activity in the building, shipbuilding, electrical and general engineering, motor-car and other trades, and world-wide rearmament, were forcing consumption still higher." In the view of the Corporation the trend of trade and commodity prices should continue upwards.

### Fried Krupp Report

Friedrich Krupp A.-G., Essen, in their financial report for the year ended September 30 last, state that income advanced by 24 per cent. over 1934-35. Increase in taxation was about 50 per cent. and in wages 15 per cent. The net profit was 14,400,000 Rmk., against 10,340,000 Rmk. in the previous year, after placing 43,470,000 and 31,950,000 Rmk. respectively to depreciation. Apart from the two inflation years, a dividend has been declared for the first time since 1917, and amounts to 4 per cent. on a share capital of 160,000,000 Rmk. General reserves have been increased from 30,000,000 to 35,000,000 Rmk. and the reserves for contingencies from 29,960,000 to 43,240,000 Rmk. The increased turnover is credited in the report to a more substantial demand from the building, agricultural, engineering, shipbuilding and automobile industries, and the maintenance of a high tonnage of exports.

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**A few of the PRODUCTS to be EXHIBITED :—**

**SAXPYRE**
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**and**
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**of all types**

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**STAND Nos. D.913 & 810**

# RAW MATERIALS—PRICE LIST

**(Wednesday, January 27, 1937)**

## COPPER

| | £ s. d. |
|---|---|
| Standard cash | 52 8 9 |
| Three months | 52 10 0 |
| Electrolytic | 57 0 0 |
| Tough | 56 16 3 |
| Best selected | 57 3 9 |
| Sheets | 85 11 3 |
| India | 67 16 3 |
| Wire bars | 58 3 9 |
| Ingot bars | 58 3 9 |
| H.C. wire rods | 61 16 3 |
| Off. av. cash, Dec. | 45 19 8 4/11 |
| Do., 3 mths., Dec. | 46 5 10 10/11 |
| Do., Sttlmnt., Dec. | 45 19 6 8/11 |
| Do., Electro, Dec. | 50 13 9 |
| Do., B.S., Dec. | 50 13 0 |
| Do., wire bars, Dec. | 51 0 2 8/11 |
| Solid drawn tubes | 12½d. |
| Brazed tubes | 12¾d. |
| Wire | 8d. |

## BRASS

| | |
|---|---|
| Solid drawn tubes | 11½d. |
| Brazed tubes | 13½d. |
| Rods, drawn | 10d. |
| Rods, extd. or rlld. | 6d. |
| Sheets to 10 w.g. | 9½d. |
| Wire | 9½d. |
| Rolled metal | 8½d. |
| Yellow metal rods | 6d. |

## TIN

| | £ s. d. |
|---|---|
| Standard cash | 227 0 0 |
| Three months | 227 10 0 |
| English | 227 5 0 |
| Bars | 229 0 0 |
| Straits | 229 10 0 |
| Australian | 227 0 0 |
| Eastern | 229 7 6 |
| Banca | 229 0 0 |
| Off. av. cash, Dec. | 232 5 1 4/11 |
| Do., 3 mths., Dec. | 232 4 9 1/11 |
| Do., Sttlmt., Dec. | 232 5 8 9/11 |

## SPELTER

| | £ s. d. |
|---|---|
| Ordinary | 21 16 3 |
| Remelted | 19 5 0 |
| Hard | 18 15 0 |
| Electro 99.9 | 23 12 6 |
| English | 22 12 6 |
| India | 18 5 0 |
| Zinc dust | 25 10 0 |
| Zinc ashes | 6 0 0 |
| Off. aver., Dec. | 18 1 0 3/11 |
| Aver. spot, Dec. | 17 19 11 7/11 |

## LEAD

| | £ s. d. |
|---|---|
| Soft foreign ppt. | 27 5 0 |
| Empire | 27 6 3 |
| English | 29 5 0 |
| Off. aver., Dec. | 25 10 7½ |
| Aver. spot, Dec. | 25 11 2 7/11 |

## ALUMINIUM

| | |
|---|---|
| Ingots | £100 to £105 |
| Wire | 1/3 to 1/4 lb. |
| Sheet and foil | 1/2 to 1/4 lb. |

## ZINC SHEETS, &c.

| | £ s. d. £ s. d. |
|---|---|
| Zinc sheets, English 33 | 5 0 to 33 15 0 |
| Do., V.M. ex-whse. 33 | 5 0 to 33 15 0 |
| Rods | 32 0 0 |

## ANTIMONY

| | £ s. d. £ s. d. |
|---|---|
| English | 77 0 0 to 78 0 0 |
| Chinese, ex-whse. | 63 0 0 |
| Crude, c.i.f. | 35 0 0 |

## QUICKSILVER

| | |
|---|---|
| Quicksilver | 14 2 6 |

## FERRO-ALLOYS AND STEEL-MAKING METALS

| | £ s. d. £ s. d. |
|---|---|
| Ferro-silicon— | |
| 25% | 9 2 6 |
| 45/50% | 10 15 0 to 12 0 0 |
| 75% | 15 15 0 to 17 0 0 |
| Ferro-vanadium— | |
| 35/50% | 12/8 lb. Va |
| Ferro-molybdenum— | |
| 70/75% carbon-free | 4/6 lb. Mo. |
| Ferro-titanium— | |
| 20/25% carbon-free | 9d. lb. |
| Ferro-phosphorus, 20/25% | £21 to £22 |
| Ferro-tungsten— | |
| 80/85% | 3/- lb. |
| Tungsten metal powder— | |
| 98/99% | 3/1½ lb. |
| Ferro-chrome— | |
| 2/4% car. | 31 17 6 |
| 4/6% car. | 21 10 0 |
| 6/8% car. | 21 0 0 |
| 8/10% car. | 21 0 0 |
| Ferro-chrome— | |
| Max. 2% car. | 32 10 0 |
| Max. 1% car. | 35 15 0 |
| Max. 0.5% car. | 36 10 0 |
| 70% carbon-free | 9½d. lb. |
| Nickel—99.5/100% | £180 to £185 |
| "F" nickel shot | £165 0 0 |
| Ferro-cobalt, 98/99% | 7/3 lb. |
| Metallic chromium— | |
| 96/98% | 2/5 lb. |
| Ferro-manganese— | |
| 76/80% loose | £11 15 0 to 12 5 0 |
| 76/80% packed | £12 15 0 to 13 5 0 |
| 76/80% export | £10 15 0 |
| Metallic manganese— | |
| 94/96% carbon-free | 1/3 lb. |

Per ton unless otherwise stated, basis 2-ton lots.

## HIGH-SPEED TOOL STEEL

| | |
|---|---|
| Finished bars, 14% tungsten | 2s. 0d. |
| Finished bars, 18% tungsten | 2s. 9d. |

Per lb. net, d/d buyers' works.

| Extras— | |
|---|---|
| Rounds and squares, 3 in. and over | 4d. lb. |
| Rounds and squares, under ½ in. to ¼ in. | 3d. lb. |
| Do., under ¼ in. to 7/16 in. | 1/- lb. |
| Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in. | 3d. lb. |
| Do., under ½ in. × ¼ in. | 1/- lb. |
| Bevels of approved sizes and sections | 6d. lb. |

Bars cut to length, 10% extra.

## SCRAP

| South Wales— | £ s. d. £ s. d. |
|---|---|
| Heavy steel | 3 10 0 |
| Mixed iron and steel | 3 6 0 to 3 8 0 |
| Heavy cast iron | 3 5 0 to 3 7 6 |
| Good machinery | 3 10 0 to 3 12 6 |
| Cleveland— | |
| Heavy steel | 3 2 6 |
| Steel turnings | 2 5 0 |
| Heavy cast iron | 3 10 0 |
| Heavy machinery | 3 12 6 |
| Midlands— | |
| Short heavy steel | 3 10 0 |
| Light cast-iron scrap | 2 15 0 to 2 17 6 |
| Heavy wrought iron | 3 10 0 |
| Steel turnings | 2 2 6 |
| Scotland— | |
| Heavy steel | 3 2 6 |
| Ordinary cast iron | 3 8 6 to 3 10 0 |
| Engineers' turnings | 2 7 6 |
| Cast-iron borings | 2 2 6 |
| Wrot-iron piling | 3 12 6 to 3 15 0 |
| Heavy machinery | 3 15 0 to 3 17 6 |

London—Merchants' buying prices, delivered yard.

| | £ s. d. |
|---|---|
| Copper (clean) | 42 0 0 |
| Brass | 25 0 0 |
| Lead (less usual draft) | 24 0 0 |
| Tea lead | 19 0 0 |
| Zinc | 13 0 0 |
| New aluminium cuttings | 74 0 0 |
| Brazicry copper | 40 0 0 |
| Gunmetal | 40 0 0 |
| Hollow pewter | 170 0 0 |
| Shaped black pewter | 124 0 0 |

## PIG-IRON

| N.E. Coast (d/d Tees-side area)— | |
|---|---|
| Foundry No. 1 | 83/6 |
| ,, No. 3 | 81/- |
| ,, No. 4 | 80/- |
| Forge No. 4 | 80/- |
| Hematite No. 1 | 98/-* |
| Hematite M/Nos. | 97/6* |
| N.W. Coast— | |
| Hem. M/Nos. d/d Glas. | 98/-* |
| ,, d/d Birm. | 109/6* |
| Malleable iron d/d Birm. | — |
| Midlands (d/d Birmingham dist.)— | |
| Staffs No. 4 forge | 83/- |
| ,, No. 3 fdry. | 86/- |
| Northants forge | 80/6 |
| ,, fdry. No. 3 | 83/6 |
| ,, fdry. No. 1 | 86/6 |
| Derbyshire forge | 83/- |
| ,, fdry. No. 3 | 86/- |
| ,, fdry. No. 1 | 89/- |
| Scotland— | |
| Foundry, No. 1, f.o.t. | 90/6 |
| ,, No. 3, f.o.t. | 88/- |
| Cleveland No. 3, Glasgow | 87/- |
| ,, ,, Falkirk | 84/- |
| Scottish hem. M/Nos. d/d | 98/-* |
| Sheffield (d/d district)— | |
| Derby forge | 80/6 |
| ,, fdry. No. 3 | 83/6 |
| Lincs forge | 80/6 |
| ,, fdry. No. 3 | 83/6 |
| W.C. hematite | 103/6* |
| Lancashire (d/d eq. Man.)— | |
| Derby fdry. No. 3 | 89/- |
| Staffs fdry. No. 3 | 89/- |
| Northants fdry. No. 3 | 87/6 |
| Cleveland fdry. No. 3 | 89/- |
| Glengarnock, No. 3 | 105/- |
| Clyde, No. 3 | 105/- |
| Monkland, No. 3 | 105/- |
| Summerlee, No. 3 | 105/- |
| Eglinton, No. 3 | 105/- |
| Gartsherrie, No. 3 | 105/- |
| Shotts, No. 3 | 105/- |

* Subject to a rebate of 5s. per ton under certain conditions.

## FINISHED IRON AND STEEL

*Usual district deliveries for iron; delivered consumer's station for steel.*

| Iron— | £ s. d. £ s. d. |
|---|---|
| Bars (cr.) | 10 10 0 |
| Nut and bolt iron | 8 17 6 to 9 7 6 |
| Hoops | 11 7 6 and up. |
| Marked bars (Staffs) f.o.t. | 13 0 0 |
| Gas strip | 11 7 6 and up. |
| Bolts and nuts, ¾ in. × 4 in. | 16 0 0 and up. |
| Steel— | |
| Plates, ship, etc. | 9 10 6 to 9 13 0 |
| Boiler plts | 10 0 6 to 10 3 0 |
| Chequer plts. | 11 3 0 |
| Angles | 9 3 0 |
| Tees | 10 3 0 |
| Joists | 9 3 0 |
| Rounds and squares, 3 in. to 5½ in. | 10 3 0 |
| Rounds under 3 in. to ⅜ in. (Untested) | 9 10 0 |
| Flats—8 in. wide and over | 9 8 0 |
| ,, under 8 in. and over 5 in. | 9 13 0 |
| Rails, heavy | 8 5 0 to 8 10 0 |
| Fishplates | 12 10 0 |
| Hoops (Staffs) | 10 5 0 |
| Black sheets, 24g. (4-t. lots) | 12 0 0 |
| Galv. cor. shts. ( ,, ) | 14 0 0 |
| Galv. flat shts. ( ,, ) | 14 10 0 |
| Galv. fencing wire, 8g. plain | 15 10 0 |
| Billets, soft | 6 5 0 |
| Sheet bars | 6 2 6 to 6 10 0 |
| Tin bar | 6 2 6 to 6 10 0 |

## PHOSPHOR BRONZE

| | Per lb. basis |
|---|---|
| Strip | 12½d. |
| Sheet to 10 w.g. | 13½d. |
| Wire | 14½d. |
| Rods | 14d. |
| Tubes | 16½d. |
| Castings | 14d. |

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

## NICKEL SILVER, &c.

| | Per lb. |
|---|---|
| Ingots for raising | 8d. to 1/2 |
| Rolled— | |
| To 9 in. wide | 1/2 to 1/8 |
| To 12 in. wide | 1/2½ to 1/8½ |
| To 15 in. wide | 1/2½ to 1/8½ |
| To 18 in. wide | 1/3 to 1/9 |
| To 21 in. wide | 1/3½ to 1/9½ |
| To 25 in. wide | 1/4 to 1/10 |
| Ingots for spoons and forks | 8d. to 1/4½ |
| Ingots rolled to spoon size | 11d. to 1/7½ |
| Wire round— | |
| to 10g. | 1/5½ to 2/0½ |

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/4½ upwards.

## AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

| | Dols. |
|---|---|
| No. 2 foundry, Phila. | 22.76 |
| No. 2 foundry, Valley | 21.00 |
| No. 2 foundry, Birm. | 17.38 |
| Basic, Valley | 20.50 |
| Malleable, Valley | 21.00 |
| Grey forge, Valley | 20.50 |
| Ferro-mang. 80%, seaboard | 80.00 |
| O.-h. rails, h'y, at mill | 39.00 |
| Billets | 34.00 |
| Sheet bars | 34.00 |
| Wire rods | 43.00 |
| | Cents. |
| Iron bars, Chicago | 2.15 |
| Steel bars | 2.20 |
| Tank plates | 2.05 |
| Beams, etc. | 1.90 |
| Skelp, grooved steel | 1.80 |
| Steel hoops | 1.95 |
| Sheets, black, No. 24 | 2.80 |
| Sheets, galv., No. 24 | 3.40 |
| Wire nails | 2.25 |
| Plain wire | 2.60 |
| Barbed wire, galv. | 2.75 |
| Tinplates, 100-lb box | $4.85 |

## COKE (at ovens)

| | |
|---|---|
| Welsh foundry | 30/- to 32/6 |
| ,, furnace | 24/6 to 25/- |
| Durham foundry | 24/3 to 25/- |
| ,, furnace | 21/3 to 22/- |
| Scotland, foundry | 28/- |
| ,, furnace | — |

## TINPLATES

f.o.b. Bristol Channel ports.

| | | |
|---|---|---|
| I.C. cokes | 20×14 per box | 19/9 to 20/3 |
| ,, | 28×20 ,, | 39/6 to 40/- |
| ,, | 20×10 ,, | 28/- to 28/3 |
| ,, | 18¾×14 ,, | 20/6 to 21/- |
| C.W. | 20×14 ,, | 17/- to 17/3 |
| ,, | 28×20 ,, | 35/6 to 35/9 |
| ,, | 20×10 ,, | 23/9 to 24/- |
| ,, | 18¾×14 ,, | 17/3 to 17/6 |

## SWEDISH CHARCOAL IRON & STEEL

| | £ s. d. £ s. d. |
|---|---|
| Pig-iron | £8 0 0 to £9 0 0 |
| Bars-hammered, basis | £16 0 0 to £16 10 0 |
| Bars and nail-rods, rolled, basis | £15 15 0 to £16 0 0 |
| Blooms | £12 0 0 to £14 0 0 |
| Keg steel | £26 0 0 to £29 0 0 |
| Faggot steel | £18 0 0 to £23 0 0 |
| Bars and rods dead soft, st'l | £11 0 0 to £12 0 0 |

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 19.39 to £1.]

## DAILY FLUCTUATIONS

### Standard Copper (cash)

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 52 | 10 | 0 | inc. | 21/3 |
| ,, | 22 | .. | 52 | 5 | 0 | dec. | 5/- |
| ,, | 25 | .. | 51 | 6 | 3 | ,, | 18/9 |
| ,, | 26 | .. | 51 | 17 | 6 | inc. | 11/3 |
| ,, | 27 | .. | 52 | 8 | 9 | ,, | 11/3 |

### Electrolytic Copper

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 57 | 10 | 0 | inc. | 30/- |
| ,, | 22 | .. | 57 | 10 | 0 | No | change |
| ,, | 25 | .. | 56 | 0 | 0 | dec. | 30/- |
| ,, | 26 | .. | 57 | 0 | 0 | inc. | 20/- |
| ,, | 27 | .. | 57 | 0 | 0 | No | change |

### Standard Tin (cash)

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 230 | 10 | 0 | inc. | 20/- |
| ,, | 22 | .. | 230 | 0 | 0 | dec. | 10/- |
| ,, | 25 | .. | 226 | 10 | 0 | ,, | 70/- |
| ,, | 26 | .. | 226 | 5 | 0 | ,, | 5/- |
| ,, | 27 | .. | 227 | 0 | 0 | inc. | 15/- |

### Tin (English ingots)

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 230 | 10 | 0 | inc. | 30/- |
| ,, | 22 | .. | 230 | 0 | 0 | dec. | 10/- |
| ,, | 25 | .. | 226 | 15 | 0 | ,, | 65/- |
| ,, | 26 | .. | 226 | 5 | 0 | ,, | 10/- |
| ,, | 27 | .. | 227 | 5 | 0 | inc. | 20/- |

### Spelter (ordinary)

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 22 | 7 | 6 | inc. | 22/6 |
| ,, | 22 | .. | 22 | 0 | 0 | dec. | 7/6 |
| ,, | 25 | .. | 21 | 10 | 0 | ,, | 10/- |
| ,, | 26 | .. | 21 | 17 | 6 | inc. | 7/6 |
| ,, | 27 | .. | 21 | 16 | 3 | dec. | 1/3 |

### Spelter (Electro, 99.9 per cent.)

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 24 | 6 | 3 | inc. | 21/3 |
| ,, | 22 | .. | 23 | 17 | 6 | dec. | 8/9 |
| ,, | 25 | .. | 23 | 5 | 0 | ,, | 12/6 |
| ,, | 26 | .. | 23 | 13 | 9 | inc. | 8/9 |
| ,, | 27 | .. | 23 | 12 | 6 | dec. | 1/3 |

### Lead (soft foreign, prompt)

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 27 | 18 | 9 | inc. | 12/6 |
| ,, | 22 | .. | 26 | 18 | 9 | dec. | 20/- |
| ,, | 25 | .. | 26 | 12 | 6 | ,, | 6/3 |
| ,, | 26 | .. | 26 | 11 | 3 | ,, | 1/3 |
| ,, | 27 | .. | 27 | 5 | 0 | inc. | 13/9 |

### Lead (English)

| | | | £ | s. | d. | | |
|---|---|---|---|---|---|---|---|
| Jan. | 21 | .. | 30 | 0 | 0 | inc. | 15/- |
| ,, | 22 | .. | 29 | 0 | 0 | dec. | 20/- |
| ,, | 25 | .. | 28 | 15 | 0 | ,, | 5/- |
| ,, | 26 | .. | 28 | 10 | 0 | ,, | 5/- |
| ,, | 27 | .. | 29 | 5 | 0 | inc. | 15/- |

## AVERAGE MONTHLY PRICES OF DERBYSHIRE NO. 3 FOUNDRY AT MANCHESTER.

| Year | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Yearly average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| 1900 .. .. | 4 0 0 | 4 0 0 | 4 0 0 | 4 1 6 | 4 1 0 | 3 18 0 | 3 13 6 | 3 12 6 | 3 11 0 | 3 11 0 | 3 9 6 | 3 8 0 | 3 15 5 |
| 1901 .. .. | 2 13 6 | 2 17 0 | 2 15 0 | 2 15 0 | 2 14 0 | 2 13 9 | 2 13 6 | 2 13 6 | 2 14 6 | 2 13 0 | 2 12 6 | 2 16 6 | 2 14 3½ |
| 1902 .. .. | 2 17 6 | 2 17 6 | 2 15 6 | 2 16 9 | 2 16 6 | 2 16 6 | 2 16 6 | 2 13 6 | 2 18 6 | 2 18 6 | 2 17 6 | 2 17 6 | 2 17 1½ |
| 1903 .. .. | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 |
| 1904 .. .. | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 | 2 17 6 |
| 1905 .. .. | 2 13 0 | 2 13 0 | 2 11 6 | 2 12 6 | 2 12 0 | 2 12 0 | 2 12 3 | 2 12 3 | 2 14 0 | 2 16 6 | 2 17 6 | 2 17 6 | 2 17 6 |
| 1906 .. .. | 3 2 0 | 3 5 0 | 3 3 0 | 3 0 6 | 2 17 0 | 2 18 6 | 2 18 0 | 2 16 6 | 2 19 0 | 3 0 6 | 3 1 6 | 3 7 0 | 3 0 6 |
| 1907 .. .. | 3 7 0 | 3 7 0 | 3 5 0 | 3 2 0 | 3 4 0 | 3 8 0 | 3 6 0 | 3 5 0 | 3 4 0 | 3 2 6 | 3 1 0 | 2 18 6 | 3 4 2 |
| 1908 .. .. | 2 15 0 | 2 14 6 | 2 14 6 | 2 15 6 | 2 14 0 | 2 13 0 | 2 13 0 | 2 11 6 | 2 12 6 | 2 13 0 | 2 12 | 2 12 6 | 2 13 5½ |
| 1909 .. .. | 2 13 0 | 2 12 6 | 2 11 6 | 2 12 0 | 2 12 6 | 2 12 0 | 2 12 0 | 2 12 6 | 2 14 6 | 2 15 0 | 2 14 6 | 2 14 0 | 2 13 0½ |
| 1910 .. .. | 2 13 9 | 2 14 0 | 2 14 0 | 2 14 4 | 2 15 0 | 2 15 0 | 2 14 9 | 2 15 0 | 2 15 0 | 2 15 0 | 2 15 0 | 2 15 0 | 2 14 7½ |
| 1911 .. .. | 2 16 0 | 2 16 0 | 2 16 0 | 2 16 0 | 2 16 0 | 2 16 0 | 2 16 0 | 2 16 0 | 2 16 0 | 2 14 6 | 2 15 0 | 2 15 0 | 2 15 8½ |
| 1912 .. .. | 2 17 4½ | 2 17 6 | 2 17 6 | 3 1 1½ | 3 2 6 | 3 3 9 | 3 6 3 | 3 7 6 | 3 10 10½ | 3 12 6 | 3 13 3½ | 3 14 6 | 3 5 4 |
| 1913 .. .. | 3 15 7 | 3 15 0 | 3 11 10½ | 3 11 4½ | 3 10 2½ | 3 6 10½ | 3 4 2½ | 3 2 9 | 3 1 9 | 3 1 0 | 2 19 3 | 2 17 2½ | 3 6 5 |
| 1914 .. .. | 2 17 2½ | 2 18 0 | 2 18 0 | 2 17 0 | 2 17 0 | 2 16 7½ | 2 16 0 | 3 2 10 | 3 1 0 | 2 19 9½ | 2 16 11½ | 2 18 1½ | 2 18 2 |
| 1915 .. .. | 3 1 2 | 3 3 11 | 3 5 9 | 3 18 8½ | 3 13 7 | 3 14 1 | 3 15 0 | 3 13 3 | 3 12 0½ | 3 11 1 | 3 14 0 | 4 3 3 | 3 12 2½ |
| 1916 .. .. | 4 4 6½ | 4 11 6 | 4 11 6½ | 4 7 6 | 4 7 6 | 4 7 6 | 4 10 0 | 4 12 10 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 8 6½ |
| 1917 .. .. | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 |
| 1918 .. .. | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 |
| 1919 .. .. | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 |
| 1920 .. .. | 9 13 9 | 10 0 0 | 10 5 3 | 10 15 3 | 11 10 0 | 12 2 6 | 12 5 0 | 13 1 3 | 14 7 6 | 14 5 0 | 14 5 0 | 14 5 0 | 12 12 1½ |
| 1921 .. .. | 12 11 8 | 10 8 9 | 9 2 6 | 8 2 0 | 8 0 0 | 8 0 0 | 8 0 0 | 8 1 8 | 7 4 0 | 6 7 6 | 5 7 6 | 4 10 10 | 8 0 2 |
| 1922 .. .. | 5 5 0 | 4 17 6 | 4 15 0 | 4 15 0 | 4 12 6 | 4 12 6 | 4 12 6 | 4 12 6 | 4 11 3 | 4 10 0 | 4 10 0 | 4 10 0 | 4 13 7½ |
| 1923 .. .. | 4 12 8½ | 5 0 2 | 6 2 6 | 6 8 7½ | 6 2 5 | 5 11 9 | 5 9 1½ | 5 4 0 | 5 0 0 | 5 0 9 | 5 0 7 | 5 2 9 | 5 7 11½ |
| 1924 .. .. | 5 3 0 | 5 3 0 | 5 3 0 | 5 3 0 | 5 2 10 | 5 1 3 | 4 17 11 | 4 15 6 | 4 13 6 | 4 10 1½ | 4 10 0 | 4 10 3 | 4 17 9½ |
| 1925 .. .. | 4 10 0 | 4 9 0 | 4 6 9 | 4 5 2½ | 4 3 0 | 4 0 1½ | 4 17 1½ | 3 15 7½ | 3 14 3½ | 3 13 4½ | 3 13 4½ | 3 13 2½ | 4 1 9 |
| 1926 .. .. | 3 14 9 | 3 15 3 | 3 15 3½ | 3 15 3½ | 3 17 6 | 4 5 9 | 4 16 9 | * | * | * | * | 4 12 6 | 4 0 1½ |
| 1927 .. .. | 4 13 9½ | 4 13 3 | 4 11 1½ | 4 9 4½ | 4 6 1½ | 3 19 1½ | 3 16 1½ | 3 15 6 | 3 13 4½ | 3 13 4½ | 3 14 0 | 3 13 6½ | 4 1 6½ |
| 1928 .. .. | 3 13 2½ | 3 12 3½ | 3 12 3 | 3 12 3 | 3 11 6 | 3 10 0 | 3 8 3 | 3 7 8½ | 3 7 6 | 3 7 9½ | 3 8 3 | 3 7 6 | 3 9 10½ |
| 1929 .. .. | 3 8 3½ | 3 10 4½ | 3 10 10½ | 3 11 0 | 3 11 2½ | 3 12 0 | 3 12 4½ | 3 14 6 | 3 15 1½ | 3 17 0 | 3 17 0 | 3 17 0 | 3 13 1½ |
| 1930 .. .. | 3 17 0 | 3 17 0 | 3 17 0 | 3 17 0 | 3 17 0 | 3 17 0 | 3 15 0 | 3 12 0 | 3 12 0 | 3 12 0 | 3 10 1½ | 3 9 6 | 3 14 4½ |
| 1931 .. .. | 3 9 6 | 3 9 6 | 3 9 6 | 3 9 6 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 10 |
| 1932 .. .. | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 |
| 1933 .. .. | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 | 3 7 0 |
| 1934 .. .. | 3 7 0 | 3 9 6 | 3 13 2½ | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 12 11½ |
| 1935 .. .. | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 0 | 3 14 8 |
| 1936 .. .. | 3 18 0 | 3 18 0 | 3 18 0 | 3 18 0 | 3 18 0 | 3 18 0 | 4 3 0 | 4 3 0 | 4 3 0 | 4 3 0 | 4 3 0 | 4 9 0 | 4 1 0 |

* No prices available during strike period.


# WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

# PIG IRON

REGISTERED TRADE MARK

LIMPET

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

## NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

# WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

ADVERTISING PAGES REMOVED

## Notice

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***(A remittance should accompany instructions.)***

### SITUATIONS VACANT AND WANTED

FOUNDRYMAN, 30 years' experience all types of moulding machines and methods; practical knowledge of modern requirements, general layouts and handling equipment; desires post on sales or design. Could introduce three lines with good potential market.—Box 184, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

ESTIMATOR for iron foundry mainly engaged on high-grade repetition motor and engineering castings. Birmingham area. Should have good foundry and engineering experience, quick and accurate in calculating, and capable of fixing pattern layouts and production methods; drawing office experience also an advantage. Give full details of experience, age, and wages required.—Box 186, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FIRST-CLASS Steel Melter required to operate 3-ton basic electric furnace producing plain and alloy steels in steel foundry on North-East Coast. Only first-class men need apply. Reply, stating age, experience, and wage required, to Box 202, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

METALLURGIST required for steel foundry on North-East Coast. Must have full practical knowledge of production of plain and alloy steels by basic electric process, also stock converter and tropenas processes. Knowledge of sand control and testing desirable. Only first-class men need apply. Reply, stating age, experience, and salary required, to Box 200, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

WANTED.—A practical Foundry Foreman, preferably not over 45 years, for high-class general engineering works producing 15-20 tons of iron castings per week. Knowledge of non-ferrous work an advantage. State age, experience, present position, and wages required to: British Jeffrey-Diamond, Ltd., Stennard Works, Wakefield.

WANTED.—Working Foundry Foreman for non-ferrous castings. State age, experience, and salary required.—Box 208, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

### BUSINESS FOR SALE

SALE. — Small old-established Jobbing Ironfoundry, situated Oakengates, Shropshire. Immediate possession. Ill-health reason for disposal.—Apply: Ben D. Martin, 50, New Street, Oakengates, Shropshire.

### MACHINERY

TWO Britannia Jolt Ram Machines, ramming capacity 10 cwts. at 80 lbs. air pressure; pattern draws 8" and 15"; thoroughly overhauled and in first-class condition. Price £30 each.—Wardle, Wilton House, Mellor, near Stockport.

PRACTICALLY new Sand Blast Room Plant by Tilghman, with steel room 12 ft. by 9 ft. by 8 ft. 6 in. high, complete with Tilghman compressor, 300 cub. ft. capacity, necessary air receiver, pipework and sandblast apparatus, exhausting fan, etc. This plant is not now required owing to the closing of a foundry. Can be seen in the Manchester district, as erected. Cheap price before removal. This plant is for all practical purposes as new.—Box 198, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

### MACHINERY—*Continued*

WANTED.—15-ton Side-Tipping Geared Foundry Crane Ladle.—Box 204, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

'Phone **98** Staines.

ROBEY Vertical Air Compressor, 850 c.f. at 30 lbs.

Air Receiver, 20 ft. by 3 ft., 100 lbs.

Cochran Boiler, 10 ft. 3 in. by 4 ft. 9 in., 100 lbs.

HARRY H. GARDAM & CO., LTD., STAINES.

HYDRAULIC MACHINE MOULDING PLANT AND MOULD CONVEYOR.

TWO Roll-over Moulding Machines to take boxes up to 32 in. by 22 in. by 14 in., complete with downsand frames.

Two Swing-head Moulding Machines to take boxes up to 37 in. by 24 in. by 8 in.

Hydraulic Pump, Accumulator and Copper Piping to operate the above machines.

One Platform-type Return Track Mould Conveyor, 145 ft. 3½ in. by 5 ft. 9½ in. track centres, with 66 platforms each 3 ft. 3 in. by 2 ft. 3 in. at 4 ft. 6 in. pitch. 15-h.p. Motor, 415 volts, 50 cycles, 3-phase, and reduction gear giving speeds of 6.75 f.p.m., and 4 f.p.m. Can be adapted to give 9 f.p.m.

Apply:—

MESSRS. BELLING & CO., LTD., Bridge Works, Southbury Road, Enfield.

NEW No. 4 Climax Roots Blower. Motor driven.

New No. 4 Sirocco Centrifugal Dust Fans.

New No. 2 Sturtevant Exhausting Fan.

Sirocco Exhausting Fan, 15-in. inlet.

8-in. Traversing Head Shaper.

12-in. by 16-ft. bed Dean Smith & Grace Sc. Lathe.

Redman Chucking Lathe, 25-in. chuck.

10-cwt. Stacking Truck.

OLDFIELD,

82, North Western Street, Manchester, 12.

**Tilghman Sandblast Barrel Plants; barrel sizes—60 in. x 40 in.; 36 in. x 20 in.; 20 in. x 30 in.**

**Tilghman Sandblast Cabinet Plants; 4 ft. 6 in. and 3 ft. 6 in. square (one for high pressure 70 lbs. per sq. in.); also small Cabinet 30 in. dia.**

**All complete with Air Compressors, etc.**

**Gas and Air Mixer by Sharpe & Preston, 2-in. outlet.**

**Six Osborne Pneumatic Jolt Press Moulding Machines, size 75J.**

**Three Mumford Yoke Headpress Pneumatic Moulding Machines.**

**Two Herbert Whizzer Sand Disintegrators.**

**Two Brealey Type ditto.**

**Heavy Double-ended Grinding Machines by Rowlands, Luke & Spencer, etc.**

**Hand Moulding Machines by Adaptable Darling & Sellars, Pridmore, Samuelson, etc.**

**500 Electric Motors, Dynamos, Rotary Converters, etc.**

**S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.**

**CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.**

**'Phone: Broadwell 1359.**

**THOS. W. WARD LTD.**

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